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THE LAYING-DOWN OF PASTURES.

MEASURES FOR PRESENT ABNORMAL CONDITIONS.

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THE price of nearly all grass and clover seed used in the laying-down of pastures is to-day considerably higher than it has ever been in the history of New Zealand. Even before the war there had been a gradual increase in the price of certain of our most widely used pasture seeds. At the present time, with the exception of crested dogstail and Chewings fescue, the whole of our main grass and clover seeds show an increase of from 50 to over 100 per cent. above pre-war prices. Had the increase in prices been restricted only to what may be termed the minor ingredients of mixtures, of which only from 1 lb. to 3 lb. per acre of any variety is used, the position would not have been so serious. It is, however, the great increase in the price of the two most largely used grasses—namely, rye-grass and cocksfoot—that has had the most serious effect in the rise in cost of grass-

seed mixtures. Perennial rye-grass, varying in price from about 5d. to nearly 8d. per pound, is still comparatively cheap when compared with cocksfoot, worth at the present time from 1s. 6d. to 1s. 10d. per pound for the highest-grade lines. During the past fifteen years, and especially in North Island sowings, there has been a gradual increase in the amount of cocksfoot sown per acre. At the present time in many mixtures from 10 lb. to 12 lb. of cocksfoot is not looked upon as excessive. With present prices this means an expenditure of over 20s. per acre for cocksfoot alone.

There is at the present time a general desire on the part of farmers to cheapen their mixtures as far as possible. Now, this can be done only in two ways—either by reducing the amount sown per acre, or by increasing the amount of rye-grass sown and reducing the other grasses and clovers. The first method of reducing the amount sown per acre has against it the tried experience of the past. Probably one of the most notable features of pasture-formation during the past twenty years has been the increase in the amount of seed sown per acre on all classes of country, with the exception of the drier parts of Canterbury. This increase has been brought about by practical experience, and can be looked upon as a sound and progressive policy. It therefore seems inexpedient to resort to lighter sowings than are at present adopted.

The second method of cheapening mixtures, by increasing the amount of rye-grass, is applicable only to certain types of ground and certain types of pasture. Over very large areas of New Zealand —and this refers more particularly to the North Island—a reduction in the amount of rye-grass used and an increase in other grasses has been one of the cardinal factors in our present agricultural prosperity. The bad effects of the excessive employment of rye-grass in many permanent mixtures in New Zealand, resulting in the formation of weedy pastures as soon as the rye-grass dies out, is so well known that one cannot too strongly condemn the limiting of the use of truly permanent grasses, such as cocksfoot, meadow-foxtail, meadow-fescue, and crested dogstail, and their substitution by so-called perennial rye-grass. Even at the present time, with few notable exceptions, it is in those districts where rye-grass is sown almost to the exclusion of all other grasses that the problem of laying down even long-rotation grass-land of a productive character is most acute. The present-day mixtures for long-rotation and permanent grass-land have been evolved gradually from the experience gained from over twelve million acres of sown grass-land. The mixtures in use to-day are those that have been proved to be satisfactory, and it would be the gravest of mistakes to alter them merely from the viewpoint of making the mixture cheaper.

CLASSIFICATION OF PASTURES.

Before dealing with some of the typical pasture mixtures of the present day it is necessary to briefly classify the various types of sown grass-land in New Zealand. Such a classification can best be based more or less on duration, and the following, excluding certain annual pastures, are the main types :—

(1.) Temporary pastures : These consist of grass-land that is laid down for from one to two years, and is then ploughed up and used for annual crops or, maybe, laid down in a more permanent type of grass-land. Temporary pastures are of great value, as they can be sown so as to yield a very large amount of herbage at some particularly crucial period of the year. On dairy farms autumn-sown temporary pastures are essential for producing an abundance of feed in the early spring. Spring-sown temporary pastures are also of great value. In New Zealand temporary pastures are found to be extremely serviceable in the breaking-in of ploughable fern country, and likewise during the process of eradicating blackberry before the land is sufficiently clean to lay down in long-rotation or permanent grass-land.

(2.) Short-rotation pastures : These are characteristic of the cereal-growing region of New Zealand, and last from three to four years. In general their yield after the second year is poor, and they generally have to be ploughed up at the end of the third year. The ground is then put through a rotation of crops and again laid down into short-rotation grass. The comparative poorness of short-rotation pastures is one of the weak features of New Zealand grass-land, and the method of making them profitably productive for at least four years is one of the major problems in pasture-formation.

(3.) Long-rotation pastures : These remain down from six to ten years, or even longer, being broken up when they show signs of deterioration that cannot be remedied by top-dressing.

(4.) Permanent pastures : These remain down indefinitely and are never broken up. When they are on unploughable country a certain amount of surface-sowing may be done from time to time. Burning, surface-sowing, and heavy periodical stocking with cattle and sheep are often necessary both in their establishment and maintenance. The majority of our special problems in pasture-formation are connected with the establishment of permanent grass-land on unploughable country. Grass-land on ploughable areas and intended to be permanent often becomes very inferior through errors in seeding and management, and may be turned into long-rotation grass-land.

TEMPORARY-PASTURE MIXTURES.

There is not a great variation in the mixtures used for temporary pastures, as only Italian or Western Wolths rye-grass, red clover,

and alsike are used. Two types of mixtures are used, however, one consisting only of rye-grass and the other containing in addition a varying amount of red clover and alsike. When a pure sowing of rye-grass is made the quantity used varies from 24 lb. to 30 lb. per acre. The present cost when Italian is used is from 10s. to 13s., and when Western Wolths is used from 12s. to 16s. Such mixtures are generally intended to last one year only, and, when autumn-sown, are often cut for seed in the following summer. Often a considerable amount of seed is shaken out during harvesting, and a good second-year pasture may be obtained by re-seeding in this manner. When clovers are used in addition to rye-grass from 20 lb. to 24 lb. of rye-grass, together with from 2 lb. to 4 lb. of red clover and 2 lb. of alsike, represent the average mixture used. The cost works out at from 17s. to about 22s. per acre. As temporary pastures fulfil very special and important functions, their high cost at present should not limit their employment. The only point from an economy standpoint is whether the amount of clover could be cut down without reducing their value. When the temporary pasture is required specifically for early spring feed on dairy farms the clover can be eliminated, but if required also for hay and for late summer feeding, such as for the flushing of ewes, the clover must not be stinted.

SHORT-ROTATION-PASTURE MIXTURES.

Short-rotation-pasture mixtures consist essentially of perennial rye-grass, and their cost is by no means so seriously affected by present prices as are those for long-rotation and permanent pastures. An average Canterbury Plains short-rotation mixture would work out somewhat as follows:—

Perennial rye-grass ..	24 lb.	Red clover	2 lb.
Cocksfoot	2 lb.	White clover	1 lb.

This without the white clover would cost about 17s., and in the vicinity of 20s. were that clover included. On land where white clover generally comes up naturally its omission in the mixture is often quite justified. I consider, however, that the mixture quoted above is quite an inadequate one for the greater part of the country on which it is sown at the present day. A type of mixture that I consider should be used on the average wheat-country of the South Island is somewhat as follows:—

Perennial rye-grass ..	16 lb.	Crested dogstail ..	2 lb.
Italian rye-grass ..	4 lb.	Red clover	2 lb.
Cocksfoot	8 lb.	White clover ..	1 lb.

This would work out at about 31s. an acre, and I fear the Canterbury farmer would scorn the idea of spending that amount on the seeding of his short-rotation pasture. He will, no doubt, be more

inclined to limit his sowing to a bushel and a half of perennial rye-grass, costing, say, 13s. per acre. There is no doubt, however, that the generally poor condition of many South Island short-rotation pastures after their second year is due to their lack of cocksfoot and a good bottom grass such as crested dogstail. When there is a proper realization of the intense value of cocksfoot in increasing the productive duration of short-rotation pastures no doubt cocksfoot will figure as one of the dominant elements of the mixture. However, the price of cocksfoot is at present so high that it is doubtful whether it would be a sound policy to increase the amount in this season's sowings of short-rotation grass-land. The production of a poorer short-rotation pasture has only a bad effect temporarily; no permanent damage is caused as with permanent pasture. It is therefore almost certain that, in Canterbury at least, the short-rotation-pasture mixture will consist, until prices again become normal, essentially of perennial rye-grass.

So far as the wetter parts of the cereal-growing areas of the South Island are concerned the seeding of short-rotation pastures varies from 35 lb. to 45 lb. per acre, and perennial rye-grass is also the dominant constituent; but increased amounts of timothy, meadow-fescue, cocksfoot, and dogstail would greatly improve such sowings. Here again, however, almost pure sowings of perennial rye-grass, costing well under 20s. an acre, are likely to be favoured as long as prices remain high. Although it will be a pity to see this rather non-progressive policy carried out, still, as in the drier parts of the South Island, the ill effects will be only transitory, and can be remedied by the use of more rational mixtures when prices are easier than at present.

LONG-ROTATION AND PERMANENT-PASTURE MIXTURES.

In point of fact long-rotation and permanent-pasture mixtures are very similar in composition, and a mixture used for long-rotation purposes in one place may be used for the laying-down of permanent grass-land in another. Long-rotation-pasture mixtures intended to remain down from six to ten years or even longer are greatly on the increase in the North Island. Ploughable surface-sown grass-land where the composition of the herbage is inferior is gradually becoming resown with long-rotation mixtures. These are destined to remain down for many years, provided they remain profitable, but are likely to be ploughed up again, put under some temporary system of annual cropping, and again laid down in long-rotation grass.

In long-rotation and permanent-pasture mixtures perennial rye-grass is only in special instances the dominant grass used. Such is the case in certain parts of New Zealand — the Hastings plain and the Sandon district, for example. On such country rye-

grass remains more or less permanent, and almost pure sowings may remain extremely productive for an indefinite time. This class of land is termed rye-grass country, and on it perennial rye-grass will always remain the dominant grass used. Sown at the rate of 2 bushels per acre, with perhaps 1 lb. of crested dogstail and 2 lb. of clovers, such pastures can be seeded at the present time for from 25s. to 30s. per acre, a price that is not really excessive for high-grade long-rotation or permanent pasture even in normal times. A point worth noting with regard to rye-grass country in the North Island is that South Island seed is rarely, if ever, intentionally sown, farmers invariably demanding North Island seed. Theoretically there should be no difference between South and North Island seed, but I have too much regard for the established procedure of the successful farmer to place theory before practice.

There are only certain parts of New Zealand that are truly rye-grass country. On all other areas of what may be termed first-class country the first essential in the formulation of long-rotation and permanent-pasture mixtures is the determination of the relative amount of rye-grass and cocksfoot that should be sown. For my part, so far as surface-sown grass-land is concerned, I take 12 lb. of cocksfoot, 6 lb. of perennial rye-grass, and 3 lb. of Italian rye-grass, plus other grasses and clovers, as the standard for cocksfoot country. On the other hand, on cocksfoot-rye-grass country I make the standard 6 lb. of cocksfoot, 12 lb. of perennial rye-grass, and 3 lb. of Italian rye-grass, plus other grasses and clovers. On no account would I on any type of first-class land reduce the amount of cocksfoot used below 6 lb. per acre, except in the case of rye-grass country such as the Hastings plain, and even there I should include from 3 lb. to 4 lb. of cocksfoot in the mixture.

The cost of long-rotation mixtures is at present extremely high. A mixture that has been used at the Weraroa Central Development Farm is as follows:—

Perennial rye-grass ..	8 lb.	Meadow-foxtail ..	3 lb.
Italian rye-grass ..	6 lb.	*Poa trivialis*	1 lb.
Cocksfoot	8 lb.	Cow-grass	3 lb.
Meadow-fescue ..	8 lb.	Alsike	1 lb.
Timothy	2 lb.	White clover	1 lb.

Total, 41 lb.

The present cost of such a mixture would be approximately £2 14s. per acre, and this is clearly greater than any farmer would allow himself to spend. In such a case I would suggest the laying-down of the land either in a temporary or a short-rotation mixture, and sowing later with a mixture similar to the foregoing when prices become normal again. It seems, in fact, rather a sound policy at the

present time to limit the sowing of long-rotation grass on high-class ploughable ground and to use more temporary mixtures. In this way the cost of seeding should not exceed about 25s. per acre.

When it comes to really permanent mixtures to be sown on unploughable country there is no escape except by an actual limitation of the area of such land to be sown. So far as this season is concerned a very large area has already been prepared for sowing, and this must of course be carried out. With regard to next season, however, unless the war has terminated before the end of our next autumn it would be well for farmers to carefully consider the matter before attempting to break in any more forest or scrub land, as, apart from the danger of stinting the seeding owing to very high prices, the cost of fencing so necessary on many types of bush-burn country would be largely prohibitive.

The seeding of bush-burn country of good quality will this season be very expensive, but the cost will have to be faced. A typical mixture somewhat as follows can be looked upon as a standard :—

Cocksfoot	12 lb.	Crested dogstail ..	1 lb.
Perennial rye-grass ..	6 lb.	Meadow-foxtail ..	2 lb.
Italian rye-grass ..	3 lb.	Cow-grass	2 lb.
Timothy	1 lb.	White clover	1 lb.

Total, 28 lb.

Such a mixture would cost about 38s. per acre, and I should not advise any reduction in quantity or omission of any of the species. On slightly poorer country the mixture might be modified as follows :—

Cocksfoot	12 lb.	Crested dogstail ..	2 lb.
Perennial rye-grass ..	6 lb.	*Poa pratensis* ..	2 lb.
Italian rye-grass ..	3 lb.	Cow-grass	2 lb.
Timothy	1 lb.	White clover	1 lb.

Total, 29 lb.

The cost of this would work out at about 35s. per acre. On comparatively poor bush-burns the cost will still be heavy, owing to the necessity for still using a liberal supply of cocksfoot, and a mixture suitable for such country would be somewhat as follows :—

Chewings fescue ..	6 lb.	*Poa pratensis* ..	2 lb.
Cocksfoot	10 lb.	Crested dogstail ..	2 lb.
Perennial rye-grass ..	5 lb.	White clover	1 lb.

Total, 26 lb.

The cost would be approximately 34s., and that price can be looked upon as about as cheap as it will be possible to seed bush-burns this season without using mixtures that will give unsatisfactory results.

CARE OF MILK AND CREAM ON THE FARM.

W. DEMPSTER, Dairy Instructor, Hamilton.

THE writer has graded cream on practically every receiving-platform in the South Auckland district, and visited a number of dairy farms in different localities from which poor-quality cream was being received. In the majority of cases the farmers concerned were doing their best, often under very adverse circumstances. With a few exceptions the sheds, separators, milking-machine pipes, tubes, and other tinware were found to be clean, and there was therefore a certain amount of reason for these farmers to feel aggrieved after getting second grade for their cream.

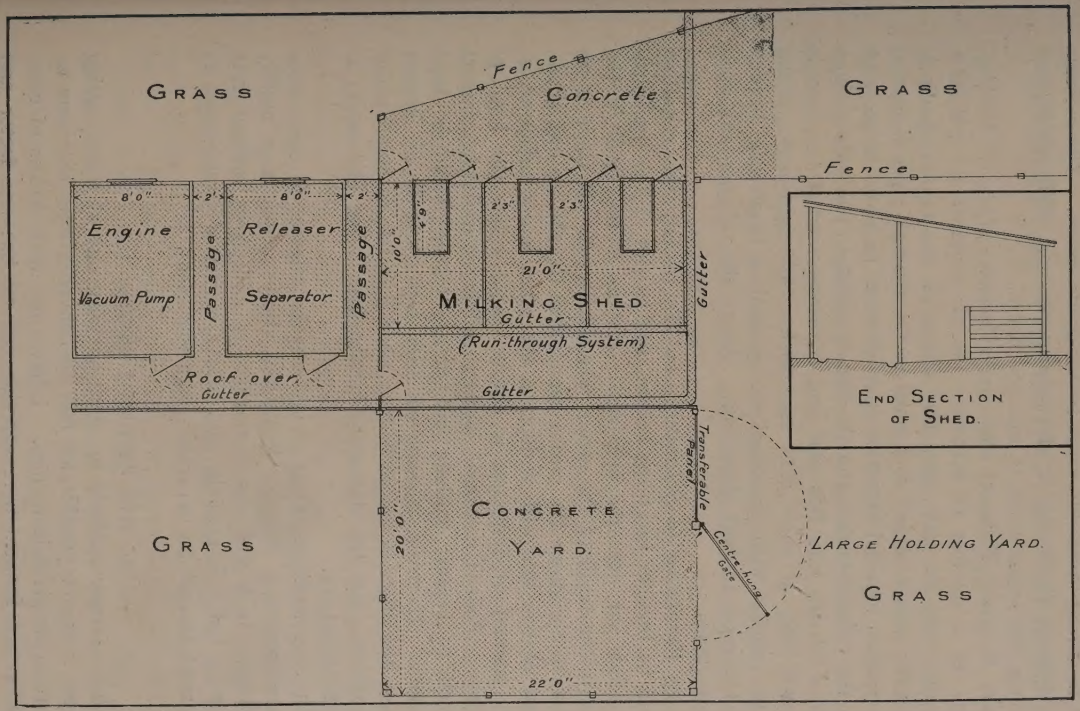
In many cases, however, a lot of money has been wasted by the farmer in building his shed and yards. Convenience for himself and the adaptability of the shed for a certain make of milking-machine have been the main considerations when designing, the factor of delivering a good cream being subservient. A number of sheds, in fact, are so designed that it is not possible to deliver an untainted cream. A properly planned shed, while being convenient, can also be laid out to have grass on three sides of the separator-room, so that the possibility of tainted cream is reduced to a minimum.

CAUSES OF INFERIOR MILK OR CREAM.

The following are five of the principal causes of poor-quality milk or cream, all of which can be rectified by the dairy-farmer :—

Neglecting to cool Milk or Cream.—Lack of cooling comes first in importance. When milk or cream is allowed to cool naturally the process takes considerable time, and the material retains a great deal more animal odour, and also develops acid more quickly, than when artificially cooled. Setting the cream-can in a tub of water is too slow in effect, and every dairyman should have a water cooler. Cream cooled by water cooler as it leaves the separator has shown only 0·2 per cent. of acid in two days, while uncooled cream of the same origin has shown as high as 0·7 per cent. Cooled milk delivered in the cities is often thirty-six to forty hours old before being consumed. Suppliers of milk to our cheese and butter factories often experience difficulty in keeping the evening's milk—when it is uncooled—until next morning, a period of about sixteen hours.

Engine and Separator in the same Room.—This condition should not be allowed. Moreover, a single partition between the two parts of the plant is not sufficient. A double partition (2 ft. apart) is



PLAN OF MILKING-SHED AND YARDS (RUN-THROUGH SYSTEM).

Engine and vacuum-pump at outer end of shed, to leeward of separator. Arrangement of two gutters in shed leaves clean walk and prevents dirt being carried into separator-room. Centre-hung gate, swinging both ways between holding-area and concrete yard; removable panels to block one entrance, allowing of change about when ground on one side cut up. Outgoing-yard falls and widens towards exit, preventing earth carrying away where cows leave the concrete, also making it difficult for a "boss" cow to jamb another.

required, with openings to outer walls, so that fresh air can blow between the engine-room and the separator-room (see plan). Where a kerosene blow-lamp is used in the same room as the separator it is found to almost invariably cause second-grade cream. The milking-machine releaser should be in the separator-room. Milk should not run through the engine-room in an open chute.

Failure to clean Vacuum-tank and Vacuum-pipes of Milking-machines.—In a number of machines the air required for pulsation is discharged into the milk, also the action of the vacuum-pump is intermittent; therefore any foul smell in the tank or pipes is carried into the milk. Especial attention is required to be given to the pipe between the releaser-bucket and the vacuum-tank. The vapour from the milk is carried into this pipe and condenses, and if the pipe is not cleaned daily it soon gets very foul. All right-angle piping should be coupled with cross-sockets, so that a brush can be run through the pipes in both directions. Leave the vacuum-tank open between milkings.

Lack of Ventilation in Separator-room.—To remedy this condition air should be brought in at the bottom and let out at the top, bird-netting being put over the openings. Just as is the smell in the dairy, so is the smell of the cream when delivered. If there is no ventilation in the dairy the cream cannot fail to take up any smell. A window on one side with a door on the other is not sufficient, as a certain amount of dampness is always found below the level of the window. Pollard, calf-meal, harness, milking-overalls, &c., impart their smell to cream: nothing but dairy utensils should be kept in the dairy. If cream is removed after separating in an impure atmosphere the effect is not so bad as when it is left to stand under such conditions, but the damage is really done when the cream is leaving the separator.

Muddy Surroundings.—Cows should not be allowed to come near the separator-room. More or less smell always arises from muddy surroundings. It is well-nigh impossible to milk cows without ever making mud, but it is possible and only a matter of arrangement to have no mud around the separator-room (see plan).

ALL FIVE FACTORS ESSENTIAL.

If a dairy-farmer neglects to carry out any one of the foregoing five factors it is not possible for him to deliver a milk or cream as good as the cow gives it to him. I have met with dozens of cases where individual farmers were carrying out all but one factor and yet had second-grade cream. By attending strictly to these five essentials, and with proper cleanliness, it will be only an accident if the farmer gets second grade.

ACCIDENTAL POISONING OF LIVE-STOCK.

B. C. ASTON, F.I.C., Chemist to the Department.

NUMBERS of valuable domestic animals are yearly lost in this country through being allowed to have access to poisons used on the farm. Brief notes of these cases have been recorded in the last two annual reports of the Chemistry Section, but as these have necessarily a somewhat limited circulation it is deemed advisable to refer more fully to the matter in the *Journal*.

The most prevalent source of this accidental mortality in stock is due to poisons such as the lead compounds in paint, the arsenical compounds in dipping-fluids and weed-killers, the phosphorus and strychnine in rabbit and bird poisons. Carelessness, for instance, in leaving a single disused paint-tin in a paddock may be responsible for the deaths of several cattle. Cattle should on no account be allowed to lick freshly painted buildings, bridges, or fences. They assuredly will do so if they have the opportunity, as lead paint mixed with linseed-oil apparently has a great attraction for cattle. Another form of poisoning is that arising in pigs from the giving of salt or saline liquids, to which pigs are very susceptible. No doubt many valuable pigs are annually lost through want of a little care in respect to what is thrown into the pig-trough.

The following account of excessive mortality in a herd of cattle is interesting as an example of what has been stated, and also in reference to the remarkable Wangaehu River. A mob of 252 young cattle from eighteen months to two years and a half old were driven at the rate of from six to fourteen miles a day from Marton to Mangamahu, at which place they arrived four days later. Within an hour of arrival a number became ill, nineteen died the first day, and eighteen within the next four days. The symptoms as described by Mr. O. Mackley, Stock Inspector, Wanganui, who performed a post-mortem and found nothing abnormal, were to the effect that the cattle affected lay down and died, some within ten minutes of arrival, without showing the slightest sign of pain beyond the twitching of the eyes and lips. He reported that the cattle had been drinking in the Wangaehu River, and forwarded specimens of stomach-contents, small intestines, liver, and spleen. From the portion of the rumen and intestines forwarded arsenic was isolated, equivalent to 0·0161 gram of an arsenious oxide (white arsenic), and

from one-third of the liver 0·0113 gram. The Inspector was advised and asked to obtain samples of the water from the Wangaehu River. A sample of the river-water collected, unfortunately, about a fortnight after the mortality commenced, since which there had been heavy rain, was forwarded, and also a sample of stagnant water from a hole on the roadside; but both these samples gave a negative result when tested for arsenic, and it was suggested in communicating this result to the Inspector that the cattle obtained the arsenic from some source other than the Wangaehu River or the water-hole from which they had drunk. This led to the discovery of a sheep-dip drum which apparently had stood under the overflow-pipe of a rain-water tank, and from which the cattle had drunk not more than 1½ gallons altogether. A sample of the sediment in the bottom of the drum was found by analysis to contain a large quantity of arsenic.

The Wangaehu River is well known to be poisonous for some distance from its source, but in the above instance it cannot be suspected.

Skey (1868) ("On the Water from the Wangaehu River, Onetapu, Auckland, furnished by Gilbert Mair, Esq., R.M.": Proceedings Wellington Philosophical Society, p. 28, Trans. N.Z. Inst., Vol. 1, first edition) states that the waters are intensely bitter and of a milky colour for many miles from the source, the bitter taste of the mineral substance which the water holds in solution being quite appreciable at the mouth of the river after a course of about seventy miles. He found that the water contains potash alum, chloride of magnesium, and protochloride of iron, the total mineral matter being 456 grams per gallon. The colour was persistently turbid from the presence of suspended clayey matter. (See also Trans. N.Z. Inst., Vol. 10, p. 424.)

The Wangaehu River rises near the summit of Mount Ruapehu (9,175 ft.), and although not visibly connected with the hot lake on the summit of the mountain there is little doubt that it derives its waters therefrom. This is believed by Cussen (1896) (Trans. N.Z. Inst., Vol. 19, p. 379), and Friedlaender (1898) (Vol. 31, p. 508), also by Girdlestone (personal communication). Hill (1894) (Vol. 27, p. 686) points out, however, that there is no visible connection. Field (1896) (Vol. 29, p. 615) records that following the activity of Ruapehu the waters of the Wangaehu, from being "sweet and pure," became sulphurous, and numbers of New Zealand loach (kahanaenae) floated dead. The composition of this river-water may therefore vary greatly from three causes: (1) the rainfall, (2) the melting of the snows on Ruapehu, and (3) the increased flow of thermal waters. The first two factors would tend to make the water less poisonous and the last to make it more poisonous.

WIND-BREAKS FOR FRUIT-FARMS.

THE NATIVE SHRUBS SPECIALLY COMMENDED.

J. H. SIMMONDS, Auckland.

Paper read under the auspices of the Auckland Education Board.

In a paper on wind-breaks for fruit-farms we cannot turn aside to discuss the planting of large timber-tree belts such as are possible on extensive agricultural farms and runs. We must restrict ourselves to the narrower view implied by our title. There will, however, be a considerable number of cases in which the orchardist will have adjacent to his fruitgrowing land an area that is too rough or too poor for anything but timber-growing. This may very well be planted with trees that will serve the double purpose of shelter and timber-production. Firewood, fencing-posts, and sawn timber will all be of increasing value as time goes on, and the man who can produce them for himself will be in a much better position than his neighbour who has to purchase them at the high prices that are certain to rule in the near future. But the timber-trees must be kept sufficiently far back to prevent them coming into conflict with the fruit-bearing trees.

There are three ways in which tall forest-trees placed in close proximity to an orchard will do harm: (*a*) Their roots, unless cut by a deep trench, will run amongst the roots of the fruit-trees and rob them of a great part of their food; (*b*) they will catch the wind-swept rains from the quarter towards which they are situated, and cause a dry belt inside the orchard of a width proportionate to their height; (*c*) if on the sunward side, they will throw over the fruit-ground a depressing and very injurious shade.

For these reasons big trees must be kept well back. Wherever practicable a belt of open pasture should come in between the forest plantation and the orchard. Then there will be neither waste of land nor injury to the fruit-trees. An ideal arrangement would be to have your orchard fenced with an eight-wire fence, surrounding it on all sides a belt of open pasture, and standing back clumps and belts of timber-trees sufficiently tall and strong to effectually break all winds. There is, of course, a limit to the distance at which big shelter can afford us the desired protection. The reason is this: When a stream of air strikes a dense barrier it becomes compressed, rises, flows over the barrier, and descends again to the earth at an acute angle. If the barrier is too far away from the orchard, the descending stream of air will fall within it instead of passing over.

The foregoing remarks apply to fruit-farms upon which there are areas of land suitable only for timber-growing and pasture. We have now to consider the numerous cases in which all the land on the farm is good enough for fruit-production, and where wind-breaks must be

as severely restricted as is consistent with effectiveness. The problem presented in such cases is a somewhat complex and difficult one. We have to consider in respect to every break we establish (1) whether it will duly protect the fruit-trees, (2) what will be the rental value of the land it is to occupy, and (3) what will be the cost of keeping it in order from year to year and of eradicating it whenever it may have to be removed. That is to say, we have to try and establish breaks that will effectually arrest the sweep of the winds, that will occupy as little land as possible either with their tops or their roots, and that will impose the minimum of labour and expense in subsequent control or ultimate removal.

With these three essential conditions clearly in mind we may now look at some groups of plants that have been more or less tried and commended for wind-break purposes.

CONIFERS.

Out of the hundreds of plants included in this group we need refer here only to the few that have been used to any considerable extent in the formation of wind-breaks in this country. These are *Cupressus macrocarpa*, *Cupressus Lawsoniana*, *Pinus insignis* (syn. *Pinus radiata*), and *Pinus muricata*. These all grow rapidly, and if planted 4 ft. to 6 ft. apart they will soon make a dense and strong wind-barrier. *C. Lawsoniana* has the remarkable habit of permanently retaining its side branches right down to the ground, and is therefore eminently suitable as a wind-break tree. For shelter-breaks on a farm in a cool inland climate like that of the Waikato it is of very high merit.

But these four conifers are all large-growing trees that can be maintained as hedge plants only by being dwarfed. The dwarfing process consists in persistently cutting at the sides and on the top. We cannot dwarf them by any one treatment. The cutting of last year will not suffice for this. We are at warfare with nature and must not relax our efforts for a single season; for if we once let these trees get away from us and then severely cut them back it is pretty certain that some of them will die, *C. macrocarpa* being especially liable to fail us in this way.

The dwarfing process is one that requires skill as well as a great deal of labour. It is almost impossible to prevent any hedge formed of naturally large-growing conifers from increasing in perpendicular as well as lateral measurement. It soon becomes necessary to use ladders or staging for doing the cutting; and, obviously, after that the cost of keeping the hedge under control will increase with accelerated ratio for every additional foot of height. Then there is the root question. Conifers develop most of their roots near the surface. Cutting their tops will to some extent check their roots, but something more than this must be done if the hedge is not to make exacting demands upon the food provided for the fruit-bearers. Either a trench must be kept open or there must be frequent deep ploughing.

Dwarfed pines certainly make effective wind-breaks for a limited number of years, and the opinion of men who are successfully so using them must be respected; but we must not forget the numerous cases in which both cypresses and pines have got out of hand and have had to be totally removed at great cost. The place for conifers is

not within or very near an orchard, but on broken and poor areas where fruit cannot be grown. On such areas far enough away from the orchard they will both provide shelter and yield much-needed timber; but the man who plants them in close contiguity to his fruit-trees loads himself with an annually recurring burden and a future difficulty that others may well pause to consider before they follow his example.

EUCALYPTS.

In accounts of fruit-production in California we often read about eucalypts being used for wind-break purposes. The late A. J. McClatchie, in his splendid work entitled "Eucalypts cultivated in the United States," described the method and its results. The fruit-farms are extensive and devoted largely to the production of oranges and lemons. The eucalypts are planted in rows or belts about 150 yards apart, the rows being placed as nearly as possible north and south. The shelter-trees are kept in a vigorous state of growth and their roots prevented from spreading amongst the fruit-trees by an irrigation trench cut along each side of the row or belt. The winds are arrested and broken, but they do not rise over the tops of the trees and fall down again amongst the fruit-bearers as would be the case with a high solid wall. The air to a certain extent passes through, but does no harm. A second benefit derived from these belts of tall trees is that frosts are either prevented or greatly modified. Various species of eucalypts are recommended, but the one most generally favoured appears to be *E. globulus* (Tasmanian blue-gum).

No comment is needed to show that the scheme would work only where the fruit-farm is very large or where several adjacent farms are managed co-operatively in respect to shelter. It is never safe to assume that because a method has succeeded in one set of conditions it will serve the same purpose elsewhere. If one could personally inspect the fruit-farms in California, it would be easier to form a judgment as to the suitability of eucalypts as wind-break trees in some of our own larger fruitgrowing districts. In warmer parts of the North Island *E. globulus* would certainly not be admissible, as it is here attacked by too many insect enemies. If we are to adopt eucalypts, our choice must fall on species that are immune from diseases and pests. *E. coriacea, E. acervula, E. capitellata, E. botryoides, E. obliqua,* and the ironbark *E. paniculata* suggest themselves as possible. For very cold districts the list might be increased by adding *E. coccifera, E. Gunnii,* and *E. urnigera.*

The eucalypts have a great advantage over nearly all the conifers in being able to sprout and grow again from the stump when cut low down. In a large mixed break where the spaces between their stems are filled up by shade-bearing shrubs they are excellent; but none of the timber-yielders are very suitable for planting in close contiguity to fruit-trees. Whether any of the low-growing mallees that naturally send up numerous stems from near the ground would serve better for such purpose in this country is a question for settling which no evidence is as yet available.

WATTLES.

It is said that there are altogether some five hundred distinct species belonging to the group popularly designated "wattles," and

that about three hundred of them are indigenous to Australia. How many members of this great group there are that upon trial would prove to be beautiful and useful about our homesteads we cannot guess. Only a few have as yet been successfully cultivated in New Zealand, and in a paper like this one must confine himself to plants about which we know something by actual experiment and observation. Of the true acacias, the forms most generally known in this country belong to the species *A. decurrens*. The species includes six varieties, of which three are now well established in the North Island. These are as follows: *A. decurrens*, variety *normalis*; *A. decurrens*, variety *mollis* or *mollissima*; and *A. decurrens*, variety *dealbata*.

Variety *normalis* has a very finely divided leaf, is a sturdy upright grower, and bears in the month of August a profuse mass of deep-yellow flowers. It is the most beautiful of all the acacias yet introduced into New Zealand, and probably the most suitable for planting as an ornamental shelter-tree; but it must be planted where it can grow to its full height of about 30 ft., as it resents any severe pruning. The word *decurrens* means "running down," and has reference to the bark on the stalk of the leaf running down in a sharp ridge below the junction of the leaf with the twig. Variety *normalis* shows these leaf-ridges in a very marked degree.

Variety *mollis* is the one commonly called "black-wattle." It is a much taller tree than variety *normalis*, has a less finely divided leaf, and bears flowers that are pale yellow in colour. It is good for temporary orchard shelter while young, but when full grown is too large for any position very near fruit-trees.

Variety *dealbata* has a palish leaf, bears deep-yellow flowers, and grows to a height of 60 ft. or 70 ft. It is very hardy and vigorous and endures severe frost, but has the bad vice of throwing up numerous suckers, thus becoming a troublesome weed. *V. normalis* and *V. mollis* never throw up suckers.

Acacia melanoxylon and *A. pycnantha* both have the remarkable habit common to many acacias of dropping the frond-like leaf and expanding the leaf-stem or petiole into a blade like a leaf and serving the same purpose. The former makes a very dense wind-break, but stands condemned as being a most persistent suckerer. The latter is very ornamental, but too slow and uncertain in this country for shelter purposes.

Albizzia lophantha.

All the wattles are more or less nitrogen-fixers and enrichers of the soil upon which they grow; but the one most friendly to other vegetation and most likely to help the orchardist is the soft or pig wattle, known by its broad frond-like leaves, its flowers in pale-yellow tufts, and its seeds resembling tares. It is not now classed with the acacias, but with the albizzias. Its specific name is *lophantha*, which means "tuft-flowered" or "crest-flowered." It is easily propagated by sowing the seed where the plants are to grow, and in its young state is one of the most rapid growing of all plants. It bears side-trimming and top-cutting while young, but never sprouts again from the stump if cut low down. It never throws up suckers, and is so easily destroyed that it can never become a weed. Its foliage is

eagerly eaten by cattle and its seeds by pigs and poultry. As a soil-enricher it is perhaps without equal, crops following it always being in a remarkable degree stronger and better than on adjacent land where it has not grown. Fruit-trees growing near it will send their strongest roots in its direction to partake of the nitrogen which its roots are constantly fixing. It is soft to handle and easily pruned, and the prunings when dug in make good manure. As a pruned orchard wind-break it can be kept in order for several years; and if then cut down, another break will immediately spring up to take its place from the seed lying in the ground and ready to germinate. The wood makes good domestic fuel, and yet decays so quickly in the ground that stumps and roots are dissolved into humus within a year or two after the parent trees have been removed.

Albizzia lophantha is not a tree to be allowed to grow to maturity, as it then loses its beauty and is liable to be uprooted by the wind. Unfortunately, it cannot endure very severe frosts, and hence is restricted in range. But as a nitrogen-fixer and as a temporary shelter-plant it should find a welcome place in every orchard where climatic conditions will permit it to grow. To a limited extent this wattle will bear the shade of other trees, which is a further great merit in any plant used for shelter and soil-fertilization. It is useful for sowing in eucalypt plantations to fill up between the stems of the larger trees.

OAKS.

There are many species of the genus *Quercus*. Some are evergreen, others nearly evergreen, but very many deciduous. In this country almost all deciduous trees are badly attacked by fungoid parasites, and should never be chosen for growing where evergreen trees can equally well serve our purposes. *Quercus ilex* is one of the species that are quite evergreen. It is well known about Auckland. In fairly good land it grows vigorously to a shrub or moderate-sized tree with a very dense head of branches and foliage. It has rather small undivided leaves that are shiny on the upper surface and pale beneath. A casual observer might at first sight mistake the tree for an olive. Its acorns are dark-coloured and acutely conical. *Quercus Lusitanica* is a large-leaved tree. It is very nearly evergreen, the old leaves remaining on the tree until the new ones begin to open. Of all the oaks yet introduced into New Zealand this is perhaps the one that gives greatest promise of adaptation to a wide range of conditions and of vigorous life unmarred by disease.

For wind-break purposes *Q. ilex* and *Q. Lusitanica* might perhaps be planted in combination. Both are deep-rooting plants, and will admit of cultivation being carried on quite near to them. They will both endure a great deal of pruning, and will sprout and grow again if cut back to the stump. Their wood makes excellent domestic fuel, and their fruit will always be acceptable as food for pigs and poultry. They are both bad transplanters, but can be quite easily propagated by sowing the acorns where the trees are to grow. In about four or five years either of them will begin to give effective shelter; and when once established they may be expected to live on and render good service for fifty years or more. Oaks need deep subsoil and freedom from the depressing shade of other trees.

POPLARS.

In some districts poplars have been used for wind-break purposes, preference being given to the erect-growing Lombardy type. Much may be said in their favour. They are easily propagated from either cuttings or suckers. In moist situations they make very rapid growth. They are soft to prune, and freely sprout again from the mutilated part. They are leafy in summer when shelter is needed and bare in winter when it is not needed. They are long-lived. Against them it may be urged that they require very careful management to keep them sufficiently dense at the base; that they grow very tall, and must be rather frequently cut back; that their wood is almost worthless for domestic fuel; and, lastly, that they are liable to give a great deal of trouble by throwing up suckers. It may be possible to prevent their roots from spreading and suckering by maintaining a deep trench on either side of the row or belt; but examples noted by the writer in travelling about have shown that the task is not easy, and is often not successfully accomplished. Certainly, any person thinking of planting poplars near his orchard should first consider what tax is likely to be imposed upon his labour in keeping these trees down to a proper height and in controlling or eradicating the suckers that may spring up from their roots.

SCRAMBLERS AND CLIMBING-PLANTS.

Many plants of this description have been tried in shelter-hedges and wind-breaks. The main difficulty with all of them is that they need some kind of support in addition to their own stems. A framework of dead timber is too costly and too perishable to be thought of. Living trees planted at short intervals will meet the case, but they must themselves be such as will bear side-pruning and topping. A second objection to the scramblers and climbers is the immense amount of labour they impose. To be any good they must be vigorous and rapid of growth. That means thousands of long runners to be cut off every year. *Elaeagnus Japonica* is very troublesome to cut, and is, moreover, a bad soil-robber. Such genera as *Tecoma* and *Buddleya* are soft and easily pruned, but they require too much attention for the busy man. The satisfactory solution of our problem does not seem likely to be found amongst any of the scramblers or climbers. Their place is in garden hedges where they can receive constant attention, not in orchard wind-breaks.

BAMBOOS.

A great number of kindred plants fall under this popular designation, some of which are bad weeds to be vigilantly shunned; some are said to be objectionable on account of their spines; others spread rapidly and impose great cost in eradication. But there are a few that can claim high economic value. In South Australia *Arundo donax* is grown as a source of tubes for propagating tree-plants, short sections cut from their hollow stems being found better and cheaper for this purpose than either paper or earthenware pots. In Auckland *Bambusa vulgaris* is under test for wind-breaks, with results that are so far very satisfactory and encouraging. The break is established by separating a parent clump and planting out the separated sprouts

about 2 ft. apart along the line where the break is to be. It is said that the planting should not be done in the dormant season of the winter, but in September, when the life forces of the plant are ready to promote immediate growth.

If given a good start a *Bambusa vulgaris* hedge will reach a height of 15 ft. in three to four years, and its ultimate height may be 40 ft. Old stems live on and young ones are produced each year until all spaces are so completely filled up that a dog would not make his way through. As the growth is erect and the stems and leaves are soft and harmless to touch, a plough-horse can work quite close to the break. The stems make useful temporary stakes and bars for fastening up plants or fruit-trees, and a limited percentage of them may at any time be cut out without detriment to the vitality or effectiveness of the break. So far as we know, this bamboo has not been attacked by any disease, and it does not seem likely to harbour any of the pests with which the orchardist has to contend. The rate at which it spreads is slow, but is nevertheless a factor with which we must reckon if we plant it. A time will come when the belt will have gained appreciably in width. How much per annum the spread will amount to has not been ascertained; but that eradication will some day become necessary seems certain. Whether the trouble will have to be faced in ten, twenty, thirty, or forty years we have not the experience to say. The plant makes an exceedingly tough and tangled root-system, so that the task of eradication, whenever that has to be done, will be very laborious and costly, and the longer the delay the greater will be the cost.

The author of the experiments to which reference has been made is Mr. H. R. Wright, nurseryman, Avondale, and the original clump from which he obtained his stock may be seen in the grounds of D. Hay and Son, Montpellier Nurseries, Hobson Bay, Auckland. By very carefully inspecting Mr. Wright's breaks and Mr. Hay's original clump any person may see for himself the merits of *Bambusa vulgaris*, and at the same time form some estimate of both its rate of spread and the prospective cost of digging it out at some future time. The original clump at D. Hay and Son's has been kept in check by removal of suckers for sale, but that would not be possible along both sides of a long wind-break.

A plant that can be so easily propagated, that so soon gives effective shelter, and that for many years requires absolutely no attention has very much to commend it; but the wise man must look ahead and think what may have to be done while he or his children are still working the orchard. Lack of such due foresight on the part of those who have preceded us is responsible for much of our present trouble and expense.

INDIGENOUS SHRUBS.

In our New Zealand flora we have a great wealth of evergreen shrubs that reach heights of 10 ft. to 30 ft. or 40 ft., but never become large forest-trees. Some of these plants are extremely hardy and will grow in the most exposed situations. Others are shade-bearers and will thrive around the stems of bigger and taller trees. Many of them will bear severe pruning, and will sprout and grow again even if cut

down to the ground. A few are restricted to warm areas in the North, but there are others that can endure lowland frosts as far south as Stewart Island. This rich subforest indigenous flora is at our doors; but for some reason, or lack of reason, no serious endeavour seems yet to have been made to find in it the solution of our orchard wind-break problem. For forests and big shelter-belts the exotic conifers and the eucalypts are incomparably better than our slow-growing native timber-yielders; but for low shrubbery such as is appropriate in close contiguity to an orchard or garden what could possibly be better than our beautiful subforest evergreen shrubs?

For an outside screen in exposed situations near the sea-coast there is the pohutukawa (*Metrosideros tomentosa*). This is a plant adapted by nature to endure the fiercest saline winds. It is beautiful and long-lived. If broken or cut back, it can sprout and renew its life again. For situations where conditions are milder we have the karaka (*Corynocarpus laevigata*), the mahoe (*Melicytus ramiflorus*), the numerous pittosporums and the coprosmas—all vigorous and beautiful plants that will sprout and grow again if mutilated or cut back to the stump. Mapou (*Myrsine Urvillei*), though it will not endure much cutting, is worthy of a place in a mixed belt of hardy shrubs. At Wesley Training College we have on the exposed boundary of a paddock mahoe-trees that have been giving good shelter for at least thirty years. In other localities trees equally old have renewed their life by sprouting freely from the base of the stem. We have numerous karakas, some of which after being cut back to the stump have quickly sent up from twelve to twenty new stems. *Pittosporum crassifolium*, *P. Ralphii*, and *P. eugenioides* are all doing well with us and giving acceptable shelter at four years from the planting. Coprosmas spring up amongst the other trees from seeds dropped by the birds. There are many other native plants that might with advantage be included in a mixed wind-break; but the list here given is purposely restricted to a few that have been tested in a great variety of situations.

The native shrubs, though not nitrogen-fixers to the same extent as the wattles, are in a very high degree humus-producers. There is abundant evidence to show that they are friendly to fruit-trees and will not unduly rob them of their food. Within the last six years many an orchard or garden has been established where the already existing native mixed shrubbery has served as its wind-break, and we may say without risk of challenge that results have usually been good under such conditions. The native shrubs of the class here recommended, though most of them will bear severe cutting and pruning, can be allowed to grow for long periods without being touched. Their height and their spread of root are restricted by nature. There is no need in their case of artificial dwarfing. We can therefore plant them near our fruit-trees without entering into conflict with the natural habit of their life. It is true that to grow in a quite natural manner the native shrubs will need a fair amount of room; but a belt of mixed native shrubbery 10 ft. wide will not take as much out of the ground as a single row of pines.

The objection will be raised that the indigenous shrubs are slow of growth, and that the fruitgrower cannot wait for them. In this discussion we must be fair and candid. The indigenous shrubs are

slower than pines or eucalypts or wattles. This at first places them at a disadvantage, but afterwards becomes one of their greatest merits. The rapid-growing exotics serve us with little cost for five or six years and then begin to make us pay heavily for their benefits. The slower-growing indigenous shrubs require nursing and care for perhaps seven or eight years, but after that will serve us for a lifetime at a mere minimum of attention and expense. Once established, they will even pay rent for the land they occupy by the stakes and firewood they will give us. The slow-growth difficulty is real, but not insuperable. If the land where the shelter-belts are to grow is thoroughly worked and manured, and such trees as karaka, mahoe, and the pittosporums planted a year before the fruit-trees are put in, the shelter will not be much behind requirements. But there is another quite easy way of meeting the difficulty. A few plants of black-wattle can be sprinkled along, amongst, or behind the native shrubs to run up ahead of them and give shelter while they are coming on. In seven or eight years' time the wattle can be cut out and used as firewood and the native shrubs left as the permanent wind-break.

EUGENIA SMITHII.

Closely similar in character to the softer and more umbrageous of our indigenous subforest trees is the Australian lilly-pilly, known as *Acmena floribunda*, or more correctly *Eugenia Smithii*. This, though a rather large grower, might find a welcome place in our shrubbery wind-breaks. It is a vigorous, beautiful, and long-lived tree. It branches low down and maintains a dense head of foliage. Reports state that it will sprout and grow again after the severest cutting, and that it is not subject to any disease. It is easily propagated, either by transplanting from the nursery or by sowing the ripe fruit where the trees are to grow.

SUMMARY.

All the groups of plants that have been mentioned in this paper and some that have been passed over offer themselves as candidates for a place in our wind-breaks. Every fruitgrower must make his choice, and the contention of the writer is that next to effectiveness of the shelter low cost of future control is the consideration that should weigh most in the decision. Every man who gets his living by growing fruit has enough to do without side-pruning and topping 40 to 60 or 80 chains of tall hedge every year; and if too much outside labour is brought in for work of this kind the business will not pay. Only where there is economy in working is it possible for such a business to pay. Cultivating and manuring, and pruning and spraying, and gathering and marketing of the fruit *must* be done, and often leave little enough margin of profit. If in addition there is to be heavy annual expenditure on wind-breaks, that margin may wholly disappear. An error in starting the wind-breaks may thus very easily overload the debit side of the annual account, or impose a ruinous burden for some future day.

The statements and arguments of the paper lead up to these three suggestions :—

(*a.*) The man who has adjacent to his orchard any considerable area of land that is too broken or too poor for fruitgrowing should try to solve the wind-break problem by planting clumps and belts of timber-trees.

(*b.*) The man who has only a small holding all of which is good enough for fruit-production should use for his permanent wind-breaks long-lived erect-growing shrubs that will maintain a moderate spread and height without side-pruning and topping, that can at any time be renewed by cutting back to the stump or replanting, and that can whenever and wherever necessary be totally removed at moderate cost. The most suitable of the indigenous shrubs are commended as best calculated to satisfy all these requirements. The best plant to use as a nurse for the indigenous shrubs and to give shelter while they gain size and strength is black-wattle. For temporary intersecting shelter the ideal plant is *Albizzia lophantha*, which may be sown thick and slashed down for a mulch when it is two or three years old.

(*c.*) Where several fruit-farms are adjacent the proprietors should, if possible, co-operate in establishing wind-breaks that will serve for the whole area. Under such a scheme an exposed sea-front or a background of broken hills and gullies could be planted with big shelter for the mutual benefit of all concerned.

But the purpose of this paper is not so much to give definite advice as to provoke discussion and to promote experiments with plants that promise to make effective shelter without imposing an undue burden upon the already overworked fruitgrower.

[The introductory part of the foregoing paper has been abridged for space reasons.—EDITOR.]

During the past extraordinarily wet winter several of the pasture fields at Ruakura were rather badly poached by heavy stock. These areas were put into good order again by very simple means. As soon as the weather had improved and the ground become drier the paddocks were well chain-harrowed, rolled with the Cambridge roller, and again chain-harrowed. The fields were then closed for three weeks, and a luxuriant growth of grass completed the restoration process.

The Manager of Te Kauwhata Horticultural Station (late Waerenga Experimental Farm), in the Lower Waikato, has found the following mixture to give the best results in establishing pasture on the heavy gum-land typical of the surrounding district, large areas of which have been broken in at the station: Cocksfoot, 14 lb.; crested dogstail, 6 lb.; timothy, 2 lb.; fiorin, 1 lb.; white clover, 4 lb.; red clover, 2 lb.; cow-grass, 2 lb.; lucerne, 2 lb.; chicory, 2 lb.: total, 35 lb. A little rape or Italian rye-grass is also included to shelter the young clovers. The liberal seeding of chicory is for sheep-grazing purposes as well as with the view to subsoiling-action.

CERTIFICATE-OF-RECORD TESTING.

LIST OF COWS TO END OF OCTOBER.

W. M. SINGLETON, Assistant Director, Dairy Division.

READERS of the *Journal* who are interested in the improvement of our dairy cattle will find in the appended list of recently completed records much to inspire an optimistic view of the future production of milk and butter-fat. In New Zealand, as elsewhere, there has been a much more rapid development in the manufacture of our staple dairy-products of butter and cheese than there has been in the improvement of our dairy herds. Much of the increase in our production of butter and cheese for export has been directly brought about by the milking of a larger number of cows, although there are indubitable proofs that our dairymen have improved the production of the average dairy cow to a very encouraging degree.

Reported in the present list are records of cows representing the majority of the dairying districts between Hoanga, in North Auckland, and Invercargill, in Southland. This will indicate some of the enterprise which a number of our breeders are evidencing in "doing their bit." When the fact is realized that no animal can produce food for human consumption as efficiently and as cheaply as can the special-purpose dairy cow it will be recognized that improvers of this class of stock are doing a great work in the direction of repairing the deficiency of foodstuffs brought about by the tremendous depletion of live-stock in Europe.

The list includes eleven records over 500 lb. and six over 600 lb. of butter-fat. Readers will note a new name among owners of 600 lb. cows—Mr. W. D. Hunt's animals contributing three of the six records. Of the six records over 600 lb. the South Island claims four. The South Island has many dairymen with a knowledge much above the average in respect of good handling of dairy cattle, and it is unfortunate that the number of owners of purebred stock is not greater.

Although the cows which have recently qualified for the C.O.R. list have produced quite a number of records above the average only one new class-leader has appeared since the publication of the previous list in the September *Journal*. This is Sultan's Clematis, in the senior three-year-old Jerseys. She supersedes Mr. E. B. Eagle's Belvedere Sungleam, which produced 11,044·8 lb. of milk, containing 626·46 lb. of butter-fat.

In presenting these lists the writer has often made reference to the pedigrees of animals with outstanding records. Space will not permit of this being done on the present occasion, when notes of that nature would be required for such a number of cows.

BELVEDERE SULTANA.

MODEL QUEEN.

LIST OF RECORDS TO 31ST OCTOBER, 1917.

Name of Cow and Class.	Name and Address of Owner.	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
	JERSEYS.					
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Woodstock's Baby ..	Mrs. Annie Banks and Son, Kiwitea	1 335	240·5	365	9,645·50	514·04
Woodstock's Princess	Ditto	1 335	240·5	365	9,758·70	496·48
Laurel's Princess ..	F. Cresswell, Ballance	1 347	240·5	365	7,387·10	417·82
Sabean Again ..	T. S. Edwardes, Tiakitahuna	1 315	240·5	365	6,838·30	382·87
Laurel's Daisy ..	F. Cresswell, Ballance	1 347	240·5	365	6,610·60	367·08
Rarita	R. F. Wilkinson, Pukekohe	2 38	244·3	353	5,705·40	356·15
Lady Malaprop of Willowbank	Ranford Bros., Stratford	2 72	247·7	284	6,411·40	350·80
Melia Ann's Sweet ..	W. T. Luxton, Waitara	1 352	240·5	334	5,431·00	346·25
Regent of Jersey Meadows	H. H. Phillips, Te Rehunga	1 319	240·5	365	6,688·70	337·74
Te Mara's Tango Maid	Ditto	2 21	242·6	365	6,016·30	331·78
Rosette of Willowbank	Ranford Bros., Stratford	2 59	246·4	326	5,756·60	295·40
Mountain View's Fancy	F. Adam, Hoanga ..	2 2	240·7	303	4,355·50	259·59
Senior Two-year-old.						
Salvadora II of Jersey Meadows	H. H. Phillips, Te Rehunga	2 261	266·6	347	5,712·40	324·58
Oakden Maid ..	F. Adam, Hoanga ..	2 360	276·5	296	5,693·00	305·22
Miro Meadows Dolly	A. Wigg, Te Aroha ..	2 329	273·4	296	4,574·00	286·50
Junior Three-year-old.						
Titanite's Lass ..	R. F. Wilkinson, Pukekohe	3 141	291·1	365	7,671·40	530·44
Chelsea Flower ..	T. Church, Hamilton	3 62	283·2	297	8,203·80	448·28
La Preference ..	E. O'Sullivan and Sons, Cardiff	3 13	278·3	333	7,050·30	439·37
Creametta ..	S. Bowker, Shannon..	3 62	283·2	354	7,054·50	345·11
Lady Soumise VI ..	Graham Bros., Waitara	3 7	277·7	316	5,951·40	332·32
Mountain View's Flo	F. Adam, Hoanga ..	3 13	278·3	308	5,328·40	295·62
Senior Three-year-old.						
Sultan's Clematis ..	Percy Jones, Woodville	3 344	311·4	365	11,508·30	641·29
Sweetbrier's Fancy ..	Wren Bros., Tokaora	3 319	308·9	340	9,318·20	434·22
Fox's Okioki ..	S. Jones, Patutahi ..	3 357	312·7	298	7,389·30	350·72
Mature.						
Sultan's Daisy ..	E. O'Sullivan and Sons, Cardiff	5 1	350·0	365	10,364·30	667·31
Magnet's Vixen ..	J. B. Clemow, Stratford	6 320	350·0	365	10,070·50	587·44
Gipsy Jane ..	R. Glynn Lewis, Okoroire	5 217	350·0	350	8,766·50	485·77
Jersey Lass ..	T. Church, Hamilton	10 67	350·0	337	8,154·80	465·88
Malaprop's Butterfly	Ranford Bros., Stratford	6 10	350·0	361	7,726·90	457·05
Miss Trenton VII of Coolangatta	A. E. Wright, Whangarei	9 27	350·0	365	7,676·40	447·25
Blush Rose ..	H. C. Sampson, Hillsborough	6 351	350·0	365	7,889·10	441·18
Fox's Champ ..	H. H. Phillips, Te Rehunga	5 208	350·0	363	5,810·00	386·79
Sparkle	J. Pettigrew, Pihama	5 308	350.0	360	7,040·20	375·10
Lady Evelyn ..	S. Jones, Patutahi ..	5 357	350·0	321	6,981·10	356·45

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Name and Address of Owner.	Age at starting Test.	Fat req'd. for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
		FRIESIANS.				
Senior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Heilo's Torohunga I	W. Barton, Featherston	2 334	273·9	365	12,948·70	426·64
Idol Rose de Kol of Ashlynn	Brentwood Farm Company, Wellington	2 345	275·0	321	10,275·50	361·36
Westmere Netherland Pauline	John Donald, Westmere	2 230	263·5	294	9,288·40	317·76
Aaggie Clothilde de Kol	J. H. Parkinson, Opotiki	2 335	274·0	288	9,172·70	300·25
Glenmore Pearl ..	Henry Johnson, Stratford	2 240	264·5	365	7,673·50	295·53
Queen o' Gowrie ..	John Imlah, Kaupokonui	2 311	271·6	320	8,126·90	272·61
Junior Three-year-old.						
Monavale Josephine Regina	C. C. Buckland, Cambridge	3 13	278·3	365	14,865·20	492·44
Senior Three-year-old.						
Monavale Cleopatra	C. C. Buckland, Cambridge	3 200	297·0	365	13,462·20	462·92
Junior Four-year-old.						
Glen Dhu Beauty's Own	R. Gilmour, Tiakitahuna	4 52	318·7	365	9,305·40	378·38
Senior Four-year-old.						
Lady Delhurst II ..	W. D. Hunt, Invercargill	4 322	345·7	365	20,263·30	670·62
Model Queen ..	Ditto ..	4 329	346·4	365	18,406·60	665·14
Mutual Belle of Rock	W. Barton, Featherston	4 217	335·2	334	13,554·20	469·28
Mature.						
Oakwood Topsy ..	W. D. Hunt, Invercargill	8 185	350·0	365	16,607·30	693·66
Wairuna Buttercup..	R. Colee, Greendale ..	*	350·0	365	18,714·20	643·94
Mutual Dulcina Vale	W. Barton, Featherston	5 181	350·0	365	16,949·40	589·66
Wairuna Clover ..	R. Colee, Greendale ..	*	350·0	348	15,535·60	572·60
Milkmaid of Brundee	C. Mayhead, Midhirst	6 358	350·0	285	11,386·50	397·51
		AYRSHIRES.				
Mature.						
Hilda of Ayrshire Moor	A. H. Clement, Rototuna	6–7 years	350·0	349	10,297·90	393·90
Dominion Fenwick Cherry	Moumahaki Experimental Farm, Waverley	6 16	350·0	270	9,102·30	350·87
		SHORTHORNS.				
Two-year-old.						
Alice of Dungiven ..	W. Brady, Woodville	1 355	240·5	365	7,476·10	318·30
Mature.						
Maisey	J. T. Singer, Waikanae	7–8	350·0	311	9,258·00	403·00
Mabel	,, ,,	*	350·0	340	8,716·50	370·30

* Mature.

ADDING TO OUR ECONOMIC FLORA.

USEFUL PLANTS FOR INTRODUCTION INTO NEW ZEALAND.

J. W. POYNTON, Palmerston North.

Paper read to the Manawatu Philosophical Society, August, 1917.

INTRODUCTION.

BRITISH people migrating to Australasia changed to a great extent their ancestral environment. From cold, cloudy, and damp northern areas, subject to seasonal extremes of temperature, they came to much sunnier climes, warmer, and of more uniform temperatures. But habituated as they had been for thousands of years to depend on certain valuable economic plants and animals, and finding their new homes adapted for the acclimatization of these, there was little or no necessity for them to change their habits of life or to add to the already well-proved stock and good qualities of the vegetables, grasses, and fruits brought by them to these southern lands.

Although not differing so widely as Australia from the British Islands in soil, climate, and rainfall, New Zealand has sufficient differences to encourage the attempt at acclimatization of new species of economic plants that might be expected to fail in Britain. In the first place we have milder winters (except at high altitudes), and in the coldest part of the Dominion, Central Otago, there is a very dry climate and an extraordinary amount of sunshine. All plant-growth depends ultimately on light, and this tremendous reservoir and creator of vital energy is not sufficiently recognized by us. In Nelson, Hawke's Bay, and other areas we have also strong sunlight, and the hours of recorded sunshine prove that we have in some places more solar light in the year than is received by any part of Italy. It has been proved, in regard to some plants that are found in warm zones only, that light is of greater importance to them than warmth, and where there is much light they flourish even in comparatively cold climates. We have also a more equable climate than any other like area situated as far from the tropics as are our Islands. Our normally regular rainfall is also very important. Failures of crops from weather causes are local only.

New Zealand stretches over a thousand miles in length, and lies between parallels of latitude corresponding in the Northern Hemisphere to those of central France and the whole of Spain. Our country's diversities of soil and climate are very remarkable. The wet, calm west coast of the South Island is in these features altogether unlike the Canterbury Plains, and these again differ in both respects from Central Otago. The schistose soils of Otago, the papa areas of Westland, the Wanganui watershed and the east coast of the North Island, the pumice areas of the interior, and the clay lands of the

North give great variability to our soils, each differing from anything known in Britain.

The prevailing south-west wind charged with moisture, which is mostly deposited on the west coasts of both Islands, is a climatic feature of great importance. Nelson owes its sunshine and calm to the barrier of Mount Arthur and his lesser neighbours. On the other hand, the wet area from near Dannevirke to Eketahuna is due to a gap of about thirty miles in the Ruahine Mountains, which stretches from Shannon to the north of the Manawatu Gorge. The moisture-laden western winds flow through this low saddle, and the slight elevation given to the air-current by the hills in this gap (they cannot be called mountains) cools it sufficiently to bring about condensation from Woodville to Dannevirke and Eketahuna. Farther south, near Otaki and Levin, the Tararua Mountains attain a height of more than 5,000 ft. In the path of the moving air they are like a huge rock in a deep-flowing river. They cause a calm or backwash of air, as does a rock water in the stream above it. For this reason Levin and Otaki are drier, sunnier, and less windy than either Palmerston North or Wellington. The almost constantly moving mass of air, meeting with the obstruction of these lofty areas, is divided and swirls round them to the south through Cook Strait at Wellington, and to the north through the Shannon–Manawatu Gorge gap, like the water-current at the sides of the obstructing rock. We have thus from different but clearly recognizable causes many climates which, despite our complaints about the vagaries of our weather, are fairly constant from year to year, and in time will cause changes in the nature of our introduced flora. These different soils and climates will be found suitable to the introduction of other plant-forms new to us.

The destiny of these Islands is to be the home of numerous small farmers. The extraordinary fertility of much of our soil, the general healthiness of our domestic live-stock, and the remarkably various kinds of plants that the different soils and climates are capable of producing, all indicate the lines on which the country should develop. The world is getting short of food and clothing, and will take more than this country can ever produce of wool, cheese, butter, and other primary products. Anything, therefore, that can add to these either in quantity, quality, or novelty is most important.

GRASSES.

These are the most valuable of all plants—apart from cereals, which are grasses—and are with careful selection and breeding capable of vast improvement. The good work being done by plant-breeders is now being slowly recognized. But in addition to the grasses that we as colonists have brought with us to New Zealand there are others well worth introducing.

In certain areas of the earth there are many kinds of grasses entirely unknown to New-Zealanders generally, but which are likely to be of great value to this country in future. The most promising area for exploitation and discovery in this respect is central Africa. There vast numbers of the largest animals, elephants, rhinoceri, buffalo, not to mention the countless herds of antelope, find sustenance largely, and in some cases almost entirely, on the grasses produced by

nature. The sweetest grasses are the most closely eaten by the browsing animals, and would be, of course, the least conspicuous to an untrained observer in such natural pastures. It may be taken for granted that many grasses and other forage plants are there which must be of splendid feeding-value if cultivated and improved. As much of that vast land is of high elevation—5,000 ft. to 6,000 ft. above sea-level—the climate is not so hot as might be imagined, and plants from it might be expected to thrive in the warmer parts of New Zealand.

The sugar-millet (*Andropogon Halepensis*) (durra) came from equatorial Africa. Guinea-grass (*Panicum maximum*), which grows to an immense size and gives a valuable fodder, should succeed in North Auckland. Though indigenous to tropical Africa it has thriven as far south as Buenos Aires, will sometimes grow 6 in. in a day, grows on poor clay soil and on sea-sand, and is easily propagated by slips of the stem.

There is also the giant grass *Panicum spectabile*, which has been found to grow well in cool parts of Australia, although from West Africa. The late Baron von Mueller, from whose excellent work "Select Extra-tropical Plants" many of the facts in this paper are gathered, says of this grass that it is "destined to play a great role in the pasturage of Australia."

The above examples show that grasses from very hot countries may be easily acclimatized to temperatures like our own. But the search for new grasses need not be confined to Africa. There are many kinds in other countries. From America we have received several, and in both North and South America there are many more. The blue-grass of Texas (*Poa arachnifera*) and *Paspalum dilatatum* are examples of gifts from America. Paspalum is believed by many of our farmers to be a native of New South Wales, but it was introduced by Mueller to Australia from America. In New South Wales experiments are now being made with a grass known as elephant-grass, obtained from Rhodesia three years ago. Only one plant was raised from seed, but it has since been propagated from cuttings from that plant. It promises to be a splendid fodder grass, and has grown 12 ft. high in four months. Another large Sudan grass is being tested in feeding-values, and so far the tests have been satisfactory.

There are many large grasses in tropical Australia that may be as valuable as anything that can be found anywhere. Experiments should be made with them privately and on experimental farms. In a new environment they would become more variable, and their good qualities could be intensified by breeding. In New South Wales it was found that these giant grasses succeeded much better when irrigated or in areas of high rainfall. For this reason they would probably grow better in New Zealand than in Australia.

OTHER FODDER PLANTS.

But there are fodder plants besides grasses that are worthy of attention. The remarkable results obtained from the legume *Lotus angustissimus* in the clay areas of North Auckland show that in some soils much better plants than grasses may be used. On the wet Westland areas another species, *Lotus major*, is now growing vigorously

through the bush and scrub in many places, and may, like its cousin above mentioned, be specially adapted to the peculiar conditions of Westland soils.

The splendid rice produced in the Gulf of Mexico areas—the best of all rices—was likewise introduced through a wreck distributing a few seeds which grew wild along the shore before it was recognized and cultivated.

Mueller mentions a plant that is indigenous to the Islands of Yeddo and Saghalien, northern Japan—*Polygonum sachalinense*, the giant knot-weed, known in India as "machute." If what he says about it is correct it is a most valuable fodder plant. He states, "It may reach a height of 10 ft. in three weeks. The leaves attain 1 ft. in length and 9 in. in width. The edible rootstock gets finally as thick as a man's arm, sustaining the plant in its green freshness during the driest season. It will live in temperatures from — 22° F. to + 104 F. Horses are particularly fond of the foliage, which also serves for packing and displaying fruit." Commissioner Marsden (quoted by Mueller) says of this plant, "The points in its favour are—once planted stands for ever; water will not drown it; fire will not destroy it; endures severest drought with impunity; roots penetrating deep into the soil; requires no ploughing before planting; needs no cultivation; grows where no other forage plant will exist; grows in poorest soils; is more nutritious than clover or alfalfa; affords shade to cattle in hot climates; stem and leaves, green or dry, greatly relished by cattle.

All this seems much too good to be true, and it will be asked, why has not such a plant, with so many virtues, spread over the globe? It does not follow, however, that because a plant is valuable it must necessarily soon spread over the earth or to countries not far apart and suitable to its growth. The carob, for instance, has been known, valued, and extensively cultivated all round the Mediterranean for many centuries, and is indigenous to the eastern shore of that sea. From time immemorial there has been intercourse between that shore and India, but the carob, which would be of such value to the vegetarian and stock-feeding peoples of India, was little known there. Only during the last half-century has it been extensively introduced into India, and then it was by Government agency, not by the people themselves. I have sent for some seeds of the much-praised Polygonum.

Another astonishing instance of a valuable plant long remaining practically unknown outside a defined area is that of the soya bean. To the people of northern China, Manchuria, and Japan this bean is of the highest importance, and for centuries has been grown in immense quantities. Only since the Russo-Japanese War has it become known to Europe as an economic plant and commercial product of much promise.

THE PEANUT.

The peanut (*Arachis hypogaea*) is a legume not unlike a large clover in its appearance. Its seeds are among the most nutritious of all foods, containing as they do much oil and proteid in assimilative forms. It will not fruit properly in the clayey soils of the Manawatu area. Some peanuts grown by me at Palmerston North were vigorous

enough, but could not readily work the pods into the hard dry soil in pursuance of the remarkable habit of this plant of planting its own seed. They will fruit, however, in loose, sandy, and pumice areas, and the successful growth of small patches has been reported from several parts of the North Island recently. The remarkable way in which the cultivation of the peanut has displaced cotton in parts of the United States within the last seven years shows its economic value. There are several varieties, and some would be suitable for certain localities that would not do for others.

NUTS.

The ordinary nuts of Britain—filbert, hazel, and walnut—grow splendidly in different places in New Zealand, but there are many others which should be introduced. One deserving particular attention is the pecan-nut of North America (*Carya olivaeformis*). The tree on which it grows is a species of hickory, and reaches 70 ft. in height, the wood being of value as well as the nuts. The pecan-nut will grow well only in deep river-silt. If the soil conditions are favourable the climate is not of much consequence, as the nut is found from Pennsylvania to Texas. There is very little trouble in producing the nuts; they are allowed to fall and are then gathered from the ground. The tree is so large that twelve to the acre are sufficient. It bears when ten years old. Great quantities of nuts are collected from a large prolific tree, and these sometimes bring more than 25 cents (1s.) per pound at the tree. The demand for these nuts is so great, and the areas suitable for their cultivation so limited, that they are not often seen outside of the United States.

The pecan-nut has been much improved by selection, the best varieties, such as "Success," "Paper-shell," &c., being fully twice as large as the wild pecan. I sent for some of the nuts seven years ago, but they did not germinate. They were, however, planted in unsuitable soil. We have so many river-silt soils throughout New Zealand that it is probable very suitable areas for the growth of this most valuable of nuts should be easily found. I have recently sent for some more nuts, and if successful in getting them they will be distributed in likely localities.

Another nut-tree that might with advantage be obtained for the colder parts of New Zealand would be the Nepaul nut-pine (*Pinus Gerardiana*). It thrives up on the Himalayas. It grows to 60 ft. in height, and produces very sweet edible seeds nearly an inch long. The tree also yields turpentine and much resin.

The *Pinus monophylla* of California (stone or nut pine) also gives large edible seeds of almond-like taste, much eaten by Natives. It should grow well on our mountains.

CITRONS.

During a visit to North Auckland last year I was unable to ascertain if the Washington navel orange had been acclimatized there. It should grow well in certain localities. This is the large seedless orange which at certain seasons is imported in great quantities from California. Its origin is interesting. In 1828 it appeared on a tree at Bahia, in Brazil, in the orchard of a Portuguese. The American

Consul, evidently a man worthy of his office, took an interest in it, and sent some grafted plants to Florida, where they were cultivated. When citrus-growing in California was attracting attention this orange was experimented with, with grand results. We do not now get the immense navel oranges, 4 in. in diameter, that were to be seen in our shops ten or twelve years ago. There is such a demand for them throughout the eastern United States that only the small ones come to New Zealand. The tree is now grown in Australia, and large palatable fruit has been obtained there.

The shaddock, or grape-fruit, is a large citron in much demand in the United States. It will grow as far south as New Plymouth, but until a taste is cultivated for its peculiar flavour it would be unwise to plant it largely.

The mandarin orange is but little grown in the Dominion. It is by selection being quickly improved in size and flavour, and the latest kinds would be a valuable acquisition to this country. Young trees of the pecan-nut, Washington navel orange, and shaddock can now be got in New Zealand from well-known nurserymen.

BAMBOOS.

When at Kawau Island about seven years ago I was interested in seeing many clumps of large bamboos, some of them about 40 ft. high and fully 4 in. in diameter. Notices warning trespassers against taking them were numerous, and stumps of the large ones recently cut showed that they were much in demand. The soil of Kawau is heavy clay, like much of the mainland soil, and the bamboo would probably grow as quickly over a large part of the northern peninsula as on this island. As timber gets scarcer some quick-growing plant like the bamboo will be very useful to our settlers. Many things now made of wood can be replaced by bamboo-stalks if of sufficient size. The extraordinary variety of uses to which bamboo is applied by people where it grows well is shown by the late A. R. Wallace in his interesting book on the Malay Archipelago. This family of plants is wonderfully varied. Some in central Africa grow to over 100 ft. in height with a diameter of 18 in. These grow high up on the mountains where frost is often experienced, and so might flourish here. In South America there are many useful kinds, one of them with a solid stem and of large size, that should be introduced. Fence-rails 30 ft. long are got from it by settlers there.

Away to the south, about the 50th parallel of latitude, on the Andes, in a very much colder climate than prevails in any part of the Dominion, there is a large arborescent bamboo so abundant that it forms a considerable part of the driftwood on the shores of the large lake, Buenos Aires, in which there are icebergs from the glaciers entering the lake.

THE MAHWA OR MAHUA TREE (*Illipe latifolia; Bassia latifolia*).

This tree should be introduced to North Auckland and the Bay of Plenty, where it would probably succeed. It grows all over central India in suitable soils, and up to an elevation of 4,000 ft. Its value is in the corolla of the flowers, the petals of which are produced in great quantities—2 cwt. to 3 cwt. for each tree—and are eaten by

stock of all kinds, and also by human beings. The wood is very tough. According to the *Times of India*, the Government of Hyderabad had on hand last year from the trees on public roads and reserves 26,000 tons of these dried petals. They are rich in sugar, and 10,000 tons of this stock was fermented and distilled, the alcohol produced being used for motors, and the total cost being only about one-third that of petrol. Each hundredweight of petals yields on distillation about 3 gallons of spirits. The seeds give a valuable oil up to 35 per cent. of their weight.

As the world's supply of petrol must be exhausted within measurable distance and will certainly maintain its price, the substitution of alcohol for it in heating and motor-power is likely to grow rapidly. It therefore behoves us to establish as many plants as possible through which it may be obtained. I am getting some seed of this peculiar tree from India, and will be glad to distribute it for sowing in warm northern areas.

SWEET-POTATOES.

As a useful food plant, and potentially one that in future will be most valuable as an alcohol-producer, the sweet-potato should be more extensively cultivated. Our New Zealand species, *Ipomoea chrysorrhiza*, is not used by us as food as much as it deserves to be. The extra trouble involved in its cultivation, and the unsuitability of many places for it which grow potatoes well, account for its diminishing production. Other kinds should be tried. Mueller mentions several kinds. He states that *Batatas edulis* in Victoria yields abundantly each tuber weighing from 3 lb. to 5 lb., and "in adequate climes" may attain to 56 lb., while rich yields may go up to 200 or 300 bushels from an acre.

From eastern central Australia a sweet-potato was obtained which proved hardy in the south of France. This is *Ipomoea calobra*, the tubers of which weigh from 5 lb. to 30 lb. As the tubers are increased in size by selection they are said to become coarse and less palatable, but as an alcohol-yielder and for animal-food that would not matter.

CONCLUSION.

The above are only a few examples out of hundreds of plants that may be of great importance to us—timber-trees, nuts, fruits, grasses, and other forage plants. A new economic world is open to the British people in the Southern Hemisphere and awaits exploration. It requires sustained and combined effort to get good results. Isolated individuals can do but little; they die or become old or too busy with other things to continue the work of learning about these matters and getting the seeds of new plants. When the seeds are obtained they may be put in the wrong sort of soil, or sown where the conditions, rainfall, and temperature are unfavourable.

The work of adding to our economic flora is of such tremendous importance that it is, of all things, one for the State to undertake. Trained men are necessary, and they should be furnished with the means of travel to the ends of the earth in search of new and useful additions to our list of economic plants. Travelling-scholarships in economic botany should be established by our University, and

enthusiastic young men sent everywhere—to central Africa, South America, north Australia, and especially Papua. Geologically, Papua is, like Australia, a very old land—that is, its surface has been for long aeons above sea-level—and there must be many kinds of nuts, timber-trees, grasses, and fruits there not to be found elsewhere. Further, part of Papua, although in the tropics, is a very high land, reaching to the altitude of perpetual snow. It follows that from the torrid jungles near sea-level to the snow-line there must be many forms of vegetation which have gradually altered their nature to suit their changed environment, and in such a region we must expect to find much variation in the flora. It is probable that in the high mountains of Papua there are many plants of a very useful nature that would grow well in New Zealand.

But in the oldest-inhabited areas of the globe there may be, and undoubtedly are, most useful plants suitable for acclimatization here and awaiting the attention of trained observers. It may be said that the expenses of such men would be costly; but whatever the expense (and it need not be great) the addition of one good plant to those we already have would repay such expense a thousandfold.

Grogan, in his book "Cape to Cairo," several times mentions that in different parts of central Africa he saw bows, made by the dwarfs, which for a string had a single rush. The world demand for fibre is insatiable—the longer and stronger the better. There is nothing known equal in strength to that rush, and if recognized and found capable of cultivation in quantity it would be of enormous value to the country first planting it. What a prize lies there waiting to be seized!

The advantage of trained intelligence may be shown by a few examples. It has already been stated that the Bahia navel orange (since called "Washington") owed its preservation to an intelligent Consul. The famous Western Wolths rye-grass was propagated from a single plant of more vigorous growth than its fellows, observed by a garden-loving railway hand. He planted the seed, and from it this grand grass resulted. The valuable hop known as the "Fuggles" originated and came into knowledge in this way: A hop-picker, Mrs. Stace, emptied her dinner-basket crumbs on her garden. A single seed happened to be amongst them and grew. Mr. Fuggles, a trained hop-grower, observed that it had some peculiarities, and bred from it. In each of these three instances there was an observant intelligence present which noted something, otherwise these fine botanic treasures would have been lost to the world.

Pending the State taking up this great work, individuals should do a little. Our native flora is of great botanic interest, and students of botany and directors of botanic gardens in all parts of the world desire to obtain specimens of it. Our plants all seed freely, and vast amounts of seed for exchange can easily be obtained. If about a dozen persons from different parts of the Dominion would associate for this purpose—the introduction of new plants—a great deal could be done. Seeds of exotic plants could be obtained and sown in different parts of the Dominion, and results noted. Seeds of, say, the kauri and Meryta from North Auckland, miro, kahikatea, and rimu from Westland, and others from other localities, could be

gathered by the local members and sent to one individual, who could act as corresponding secretary and the distributor of seeds collected here and received from abroad. Although extra busy just now, I would be willing to undertake this work until a good start were made, when one of the Government Departments might be induced to continue it. I would be pleased to receive the names of some persons desirous of co-operating in this useful task.

NOTE.—It may be mentioned that the Department of Agriculture has done a considerable amount of quiet work in introducing useful exotic plants into the Dominion—for instance, the American varieties of sweet-potato referred to in the last issue of the *Journal*. Doubtless this work will be extended when world conditions become normal again. There will always be room, however, for private effort in this sphere of activity. It is proposed to give in a future issue of the *Journal* a review of the economic plants introduced into New Zealand during the last twenty or thirty years, relating both negative and positive results—failures as well as successes.—EDITOR.

THE SEASON'S LAMBING.

ESTIMATE FOR THE NORTH ISLAND.

THE annual lambing in the flocks of the Dominion may be regarded as the basis of our frozen-mutton trade, and reliable early information as to the number of lambs dropped must prove of great value for regulating operations and as a check on over-exportation, especially of ewe lambs. During the last two years particulars of the lambing and shearing tallies have been taken by the police in connection with the collection of the general agricultural statistics compiled by the Government Statistician. This collection is made early in the year, but under present conditions it is impracticable to complete and publish the information sufficiently early to be of practical current value.

There remains the method of making careful inquiries in the various districts and publishing the estimates as soon as possible after the lambing is completed. For some years past the Inspectors of Stock have compiled approximate average percentages of lambs dropped in their respective districts. These percentages as regards the last two seasons were published in the *Journal* for February, 1916 and 1917 respectively. The latter issue included an estimate of the total lambing for the 1916 season, calculated on the number of ewes put to the ram, this in its turn being based on the statistics of breeding-ewes given in the annual sheep returns as at 30th April.

The Department's estimates have been found to be remarkably accurate when compared later with the actual lambing tallies collected by the police. It has therefore been decided—commencing with the current season—to compile and publish the estimates as early as possible. As the North Island lambing is on the average about a month earlier than that of the South Island, the information for the respective Islands will be published separately in two successive months. The particulars for the North Island are now ready, and are given in the following table, together with corresponding figures for the two previous years :—

NORTH ISLAND LAMBING.

Year.	Number of Ewes put to Ram.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tallied.
1917	7,475,418	87½	6,539,033	(Not yet collected.)
1916	7,230,450	85¾	6,203,726	6,212,573
1915	6,643,567	86½	5,753,329	5,771,143

As indicated, the figures for the South Island lambing will be published in next month's *Journal*.

RHIZOCTONIA (ROOT-FUNGUS) IN LUCERNE.

ALTHOUGH a comparatively robust plant, lucerne is not altogether immune from disease, the worst form known being rhizoctonia, a fungoid disease which affects the roots and, if not immediately combated, quickly kills the plant. Lucerne-growers should therefore keep close watch over the crop, as the disease, once present, spreads with alarming rapidity and quickly devastates the whole field.

Symptoms: In a healthy-looking crop single plants occur the foliage of which bears a sickly yellow appearance, and in a very short time a number of plants immediately adjoining assume a similar form. On examination it will be found that the crown of the plant is covered with a whitish fungoid growth gradually following along the main tap-root, which rapidly withers and dies. If immediately treated no ill effect further than the death of individual plants will ensue.

Treatment: Scarify the surface about the affected plants, and apply freshly burnt lime at the rate of 2 tons per acre, or sulphate of iron, ground fine, at the rate of 4 cwt. per acre. Both remedies have proved effective, and there is no need to be seriously alarmed at the appearance of the disease providing treatment is quickly applied.

Finally, avoid using on the healthy plants the implement with which the affected portion of the field has been scarified, otherwise distribution of the fungus will be rapid. Thoroughly sterilize any tools immediately after use.—*T. W. Lonsdale, Manager, Moumahaki Experimental Farm.*

GROWING CARROTS FOR SHEEP-FEED.

Mr. E. T. Macpherson, of Kohi, Waverley, who has only a limited area of cultivable land, found of late years that owing to blight and other troubles he could not grow turnips or swedes. He looked about for something to take their place, and has been experimenting with stump-rooted carrots—Early Horn and Guerande Horn varieties. Starting with an acre or two, the results were so satisfactory that last season he increased his area to 11 acres. I saw the crop, and although a portion of the land was rather dirty with couch the crop was a very good one. So far as could be noticed, Guerande Horn is the better of the two carrots, Early Horn having a tendency to crack about the month of May, especially if the root is at all large. Mr. Macpherson informed me in the middle of October that the 11 acres had carried 320 full-mouthed ewes, also four medium draught horses and two hacks, four dairy cows and one bull, for four months, and that he still had plenty of carrots for six horses and the dairy cows and bull until the end of that month. The ewes, he added, when put on were very poor stores, but at the date mentioned they were well forward and were expected to be ready as fats for the buyer early in December. Mr. Macpherson's method of carrot-growing is to cultivate the land well, and sow in November 2 lb. of seed to the acre through every coulter of the drill, with 2 cwt. to 3 cwt. of carrot-manure, giving no after-cultivation. The carrots being stump-rooted the sheep can get the greater part of them, and a stroke of two of the disk harrows turns out the shells. Farmers growing carrots for sheep-feed might also try the White Belgian variety, which stands well up out of the ground, and is thus suitable for feeding-off.—*J. W. Deem, Fields Supervisor, Wanganui.*

TOMATO-CULTURE.

(Concluded.)

W. H. TAYLOR, Horticulturist.

DISEASES AND INSECT PESTS.

The tomato is subject to the attack of several fungus diseases and insect pests, the commoner of which are briefly dealt with in the following matter:—

IRISH BLIGHT (POTATO-BLIGHT).

When first this disease broke out among the potato crops in New Zealand special attention was called to the fact that tomatoes were very susceptible to infection, and it was urged that all such crops should be at once sprayed. This advice was, however, by no means generally adopted, and the result has been that in many places heavy losses were sustained amongst tomatoes, which if timely preventive measures had been taken could without doubt have been saved. The fruit was especially badly attacked. The appearance of diseased fruit is highly characteristic. The disease first appears in patches, which become mottled with brown hard areas. Afterwards the fruit rapidly rots, and, falling on the ground, serves to infect healthy plants. Immense quantities of spores are produced on the fruit itself, and the least breath of wind scatters them far and wide.

TOMATO LEAF-BLIGHT.

This fungus, which occurs both outside and in the glasshouse, spreads with almost incredible rapidity, and in much the same way as the *Macrosporium* disease in potatoes. At first small dark-brown spots may be seen on the under-side of the foliage, then the upper side begins to show yellow, the margins curl, and gradually the whole of the leaves shrivel and die. Under glass this is always worst in badly ventilated houses; out-of-doors the attacks are most severe on imperfectly drained land, in moist situations, and especially after a prevalence of warm, moist weather.

TOMATO LEAF-RUST.

Tomato leaf-rust (*Cladosporium fulvum*) is responsible for a good deal of damage. The disease is most frequent on plants in glass-

houses. The injury first appears in the form of small spots, which increase in size until frequently the entire under-surface of the leaf becomes covered with a dense, short, brownish felt. The diseased leaves soon wilt and die. Dark stripes or patches frequently appear on the stems of diseased plants. The young fruit is also sometimes attacked. Spraying with bordeaux or sulphide of potassium is the remedy, which, however, is of little use unless commenced at a very early stage. Badly diseased plants should be removed and burnt, and spraying at once undertaken, as the spores spread very quickly. Obviously, prevention is the proper remedy; spraying should therefore be done before disease appears, and repeated at intervals. Sulphide of potassium is preferable after the early stages, as it does not discolour the fruit; ½ oz. per gallon of water is the proportion to use.

TOMATO FRUIT-BLIGHT.

On left: Showing effect of fungus attacking side of fruit—a somewhat unusual occurrence. On right: Typical specimen showing appearance of fruit after bad attack. The black fungus-growth has been washed off, leaving a yellowish-brown sunken mass.

TOMATO FRUIT-BLIGHT, TOMATO-ROT, TOMATO BLACK-ROT.

This fungus attacks the fruit when it is half to two-thirds grown, and is first observed in the form of a small circular black spot at the blossom end. This rapidly increases until fully half the tomato has collapsed, being covered by the greenish-black, velvety-looking fungus. Beyond the part actually attacked the skin of the fruit retains its normal colour. When the disease has far advanced, the skin under the affected part is found to be hard, leathery, and of a pale-yellowish or yellowish-brown colour.

SPRAYING FOR FUNGI GENERALLY AND CATERPILLAR.

Soon after setting out, and when the plants are about 9 in. to 1 ft. high, they should receive their first spraying with bordeaux—strength 3 lb. sulphate of copper and 4 lb. fresh lime to 50 gallons water.

This should be repeated about every fortnight. On the first appearance of caterpillar 1½ lb. of Swift's arsenate of lead should be added to the bordeaux. This is an effective check to that pest. On no account should the spraying be omitted.

TOMATO OR CUCUMBER EELWORM.

The following are extracts from Biology Bulletin No. 20 (now out of print), by Messrs. T. W. Kirk and A. H. Cockayne, relating to the life-history and outdoor treatment of the eelworm :—

The tomato or cucumber eelworm (*Heterodera radicicola*) appears to be spreading considerably in New Zealand, especially amongst crops grown under glass. The adult eelworm is about $\frac{1}{25}$in. long, and in shape resembles a tiny eel, being pointed at both ends. Within the gullet is a sharp, spear-shaped body, which is used for piercing the tissues of plants and extracting their juices. The young worms are developed from eggs, and in external appearance resemble the adult, only they are about one-seventh of the size. When the tissues of the plants affected decay, the young worms either fall into the soil or the eggs and young worms remain in the decaying and dead parts and become dried up with them. These eggs and young worms can withstand long periods of desiccation, and can, given suitable conditions, resume normal activities even after three or more years. This faculty makes the spread of eelworms an easy matter, and must be carefully considered when advocating any special line of treatment.

The first sign of attack is manifested by the dropping or turning yellow of the foliage. Then the whole plant becomes limp, and a complete collapse of the entire plant ensues. If an affected plant is dug up the roots will be seen to be covered with nodules, varying in size from almost microscopical swellings up to those measuring as much as an inch across. These nodules are full of eelworms, which, on the rotting of the stems, escape into the soil and then enter the roots of other plants. Once the plants are affected there is no known method by which the eelworms can be destroyed without injuring the plants.

All affected plants should be carefully dug up and burnt, and the soil in which the plants were grown should be thoroughly saturated three times at intervals of twelve days with the following solution : Carbolic acid one part, water fifteen parts. The use of gas-lime has also been advocated, but as this material is difficult to obtain the carbolic-acid remedy should be used. Soil so treated must remain at least six weeks after the last application before being replanted. When the disease appears in a glasshouse all the soil should be carefully removed outside and treated, and the interior of the house

TOMATO-PLANTS AFFECTED WITH EELWORM (HETERODERA RADICICOLA).
One-third natural size.

should be thoroughly sprayed with carbolic acid, one part to six parts of water. Soil which is known to be free from eelworm-infestation should then be carted into the house, and can be planted, and in this way the delay of six weeks can be obviated.

In outdoor culture deep ploughing, with the use of a skim coulter, is an excellent preventive practice not only against this pest, but also against many others, including insects and weeds. In garden-cultivation, trenching, so as to thoroughly bury the top spit, takes the place of deep ploughing. The destruction of the refuse of infested crops may be economically done by composting with lime. A good method of dealing with the eelworm pest is to sow a trap crop of beet. The bulk of the worms will attack this, and the crop should then be pulled up and destroyed before the eelworms have bred and again escaped into the soil.

SLEEPING-DISEASES OF TOMATOES.

The sleeping-disease of tomatoes is caused by a minute fungus known as *Fusarium lycopersici*. It was first noted as a serious disease about 1890, in the Island of Guernsey, where the cultivation of tomatoes constitutes one of the chief sources of revenue. The first indication of attack is manifested by the dropping-off of the leaves. This is quickly followed by the collapse of the stem, hence the name "sleeping-disease." If the plants are not attacked until they are nearly mature, fruit will ripen freely and to all outward appearance appear quite free from the disease; but nevertheless it is a well-established fact that seed secured from diseased plants will give rise to an affected crop.

The following is a short account of the life-history of this fungus: Certain resting spores of the fungus, present in the soil in which the young tomato-roots are growing, germinate and give rise to delicate threads of mycelium, known as hyphæ. These hyphæ, in coming in contact with the young tomato-rootlets, enter the tissues and soon find their way into the vessels of the roots, and thus stop the passage of water upwards into the leaves, in consequence of which the plant rapidly wilts. If at this stage the roots of such plants are split, the woody part will be seen to be of a dirty-yellowish-brown colour, and this is a sure indication of the presence of the disease. All such plants should be at once removed and burnt, as they are in the condition to communicate the disease to the adjacent healthy ones.

When the plants have been attacked for some time the lower portion of the stem will be seen to be covered with a delicate white bloom consisting of one of the fruiting stages. The tomato-fungus has three separate fruiting stages: (1) the diplocladium stage; (2) the fusarium stage; (3) the resting-spore stage. The resting spores are chiefly

developed in the decaying roots, and when the affected plants are pulled up large numbers remain in the soil and form the principal source of infection for next year's crop.

Owing to the mode of attack by means of subterranean resting spores, spraying the aerial portions of the plant is of very little use. All modes of treatment must have as their object the prevention of the formation of resting spores, and the destruction of any that may be in the soil before planting has commenced. Plants should be carefully removed and burnt as soon as ever the disease is noticed in them. This will prevent the formation of resting spores, and if done systematically will mean a healthy crop next season, but otherwise a diseased crop is sure to follow. The soil in the vicinity of the diseased plants should be saturated with a solution of iron sulphate, 1 lb. to 15 gallons of water. If all the plants in the house become affected, all the soil should be removed in the autumn and the whole of the inside of the house thoroughly sprayed with iron sulphate. Seed obtained from diseased plants or from a neighbourhood where the disease prevails should never be used.

TOMATO LEAF-SPOT (SEPTORIA LYCOPERSICI).

This leaf-spot is spreading rapidly in New Zealand, and is generally to be found on the leaves and stems, the fruit being only rarely attacked, thus sharply separating this disease from the tomato black-spot (*Macrosporium tomato*), which damages the fruit quite as much as it does the foliage. The treatment advocated for leaf-spot is the same as suggested for black-spot—viz., spraying with bordeaux two or three times during the season.

CERTIFICATES IN PACKING AND GRADING FRUIT.

THE following is a list of persons who have passed the Department's examination for certificates of competency in packing and grading fruit:—

Fruit-packing (First Class).—L. Abbott, Eaton Road, Hastings; H. G. Apsey, Hastings; E. Black, Stoke; B. H. Clifft, St. Andrews Road, Hastings; Miss M. G. Cook, Nelson; F. Garton, Park Road, Hastings; J. Gilfoyle, Edgeley Road, Hastings; J. Hogg, 505 Eastbourne Street, Hastings; Miss A. King, care of Mrs. Carol Harley, Van Diemen Street, Nelson; F. Moore, Riverslea Road, Hastings; J. Munson, Edgeley Road, Hastings; R. Orchard, Nelson Street, Hastings; T. C. C. Scott, Stoke; A. Wiggins, 812 Karamu Road, Hastings.

Fruit-packing (Second Class).—Miss E. G. Ledger, Nelson.

Fruit-grading (First Class).—H. J. Apsey, Hastings; J. Gilfoyle, Edgeley Street, Hastings; H. J. Hogg, 505 Eastbourne Street, Hastings; F. Moore, Riverslea Road, Hastings; F. R. Orchard, Nelson Street, Hastings; A. J. Wood, Roxburgh.

ENSILAGE IN WESTLAND.

THE suitable provision of winter fodder for live-stock—dairy cattle in particular—has long been one of the problems of agriculture in the West Coast district of the South Island, with its high rainfall and kindred climatic difficulties. Haymaking is usually a very uncertain proposition, and root-growing and feeding-off is also attended with certain drawbacks. The indications point to ensilage-making as being best adapted to the prevailing conditions, and it is therefore satisfactory to be able to record a successful local demonstration of this branch of fodder growing and conservation. During the season of 1915–16 a crop of maize was grown under the co-operative experiment system on the farm of Mr. A. H. Wheeler, at Rotomanu. In April, 1916, the crop was cut and stack-ensilaged under the supervision of Mr. W. Dibble, of the Fields Division. The stack was built in an open paddock and weighted with 1 ft. of earth. The fodder was not required the following winter, and during last summer grass 3 ft. high was growing on top of the stack, the outside appearance of which caused among local observers many doubts as to success. The stack was cut into in August last, with most satisfactory results. There was a waste of only 4 in. to 6 in. round the sides and top, the ensilage proved of good quality, and Mr. Wheeler reports that the stock ate it readily. This demonstration should encourage other farmers in Westland to try stack-ensilage. With the abundance of succulent growth normally produced in the district during the summer months—apart from specially grown crops—there should be no lack of cattle-feed in the form of ensilage at any time when the necessity arises.

Some twenty cows in the milking-Shorthorn and Jersey herds at Ruakura have been entered for semi-official test this season.

It is the practice at Ruakura to grow each season a few acres of rye-corn, the straw of which gives excellent thatching-material, and any surplus of which usually finds a market for horse-collar making. The farm recently sold to a local saddler 5 tons of rye-corn straw for this purpose at £6 per ton. At this price the crop is a very payable one; and there is comparatively little work in saving it, especially if the weather is favourable at harvest-time.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

FOR the period covered by these notes—the latter end of November as well as December—the activities of the orchardist will be mainly in the direction of summer spraying; thinning the apple and, in those instances where the work has been too sparingly done, the stone-fruit crops also; tying up and otherwise securing his trees against future possible damage through heavy bearing; harvesting the cherry, apricot, and early peach crops; and cultivating the soil for the purpose of keeping down weeds and ensuring to the tree an adequate supply of moisture for the proper development of its crop.

SPRAYING.

With reference to spraying, the principal diseases to contend with are codlin-moth, leaf-roller caterpillar, pear-slug, black-spot, brown-rot, powdery mildew, red mite, woolly aphis, black aphis, &c. The method of controlling these diseases has been so often written upon and otherwise explained by means of lectures and demonstrations by the Orchard Instructors of the Department, as well as the leading fruitgrowers of the various districts, that no one unless he is very new to the business should now be in ignorance of how to proceed. The only disease mentioned the control of which there is any doubt about is brown-rot fungus (*Monilia fructigena*), and it is hoped that before this season is ended a satisfactory means of controlling this trouble will also be found.

Despite the foregoing facts, however, large quantities of fruit are lost every year through disease, while quantities almost equally large are destroyed or partially destroyed through faulty spraying methods in the attempt to keep diseases down. With the commercial orchardist these losses are in the main not due to a lack of knowledge of what to do so much as failure to do it or neglect to do it at the right time, as well as a want of appreciation of the dangers attendant upon an attempt to undo a damage already done—in other words, endeavouring to check a disease once that disease has gained a footing.

THE DOMESTIC ORCHARD.

The case of the commercial orchardist is much more simple than that of the domestic grower. The former is in the business for a living, and must of necessity perfect himself in the work at the earliest possible moment, to which end, if he is a wise man, he will utilize the experience not only of his successes but his failures also. The domestic orchardist is, however, in a different position. In his attempt to grow

sufficient fruit for his own requirements he rarely has sufficient practice to master the intricacies of disease-control or to retain such knowledge from one season to another. In addition to this the difficulties under which he is working are usually very much greater than those of his commercial neighbour.

The typical domestic orchard is affected with almost all the local orchard diseases. The trees are usually large, dense, and unpruned, or tall, scraggy, and moss-coated. The occupier's equipment is poor and inadequate, and his time for and knowledge of spraying limited. What sort of a chance of success has a man in this position, and how much hope has a Government officer of successfully dealing with him? If he did nothing be could be prosecuted, but he very often works hard doing as good a work with the facilities to hand as could possibly be expected. In many instances, however, the condition of the fruit-trees is such than an expert orchardist would be sorely tried to make anything of them.

In the circumstances it is evident that the only satisfactory course to pursue for the benefit of the district is to destroy all such trees, and it is safe to say that during the last few years many hundreds of such orchards have been destroyed. Nevertheless, there are a good many still in existence. The orchards of this class that give the Orchard Instructor by far the greatest amount of trouble are those occupied by tenants under a weekly or monthly tenure. The average weekly tenant is entirely ignorant on the question of spraying, and as every man has to be given a chance the Orchard Instructor has to set about instructing him in the work. This in itself would be quite all right, but it usually so happens that by the time the orchardist arrives at the stage of having a "nodding" acquaintance with his duties a new tenant has taken over the property, and consequently the work of instruction has to be commenced anew. In the meantime the trees are indifferently attended to, if attended to at all, and nothing can be done owing to the fact that the tenant, not the owner, is responsible for their condition.

Circumstances of this kind are a great handicap to the officers of the Department in cleaning objectionable properties. To obviate the difficulty it is essential to amend the Orchard and Garden Diseases Act, making owners in all such cases responsible for the state in which the trees are kept.

POINTS FOR THE DOMESTIC GROWER.

Although the foregoing remarks apply to the average domestic orchard, there are many notable exceptions. There are, indeed, quite a large number of domestic orchards the occupiers of which take a keen interest in their trees and keep them in all respects as well as those of the average commercial orchard. However, for the benefit of those who lack experience in the management of their trees the writer offers the following advice. This advice in the main refers to the remainder of the season only. Full details covering the work necessary for the whole season will be given later.

1. Old infected trees the vitality of which has been materially affected by moss, scale, &c., should be destroyed. Little could be done with such by an expert orchardist having the knowledge and

facilities for doing the work. An inexperienced man would therefore have little hope of success. Prepare the site, or preferably a fresh site, and replant. With a fresh start and the advice of the local Orchard Instructor there should be no reason for the new trees ever getting out of hand.

2. For the control of codlin-moth, fungus diseases, and sucking-insects (where the trees are maintained) spray pip-fruits with arsenate of lead at the rate of ½ oz. to a gallon of water, combined with commercial lime-sulphur at the rate of 1 to 100. Repeat at intervals of not more than three weeks. To prepare a 25-gallon mixture add 1 quart of lime-sulphur to 20 gallons of water. Thoroughly mix 13 oz. of arsenate of lead with the remaining 5 gallons of water. Add this to the vessel containing the 20 gallons. Stir well, and apply as soon after as possible. Remove moth-affected fruits from the tree and ground, and destroy them. Attend to this regularly. Bandage the trunk of the trees with a strip of sacking. Remove the bandage every ten days or a fortnight, and replace after destroying the grubs.

3. In regard to brown-rot, remove and destroy all rotten or partially rotten fruit. Watch stone-fruits particularly for this disease.

4. Do not guess the weights and measures of ingredients used for spraying, but purchase a graduated measure for liquids, also a set of scales suitable for weighing small quantities, and weigh or measure everything carefully. See that the spray-pump is fitted up as conveniently and as effectively as possible. Either a knapsack or a bucket pump is generally used for small gardens. In the case of the latter see that valve, joints, &c., are in proper working-order, and that the pump is fitted with a directing-rod of from 3 ft. to 4 ft. long. Without the rod a bucket pump is of little use. With it very good work can be done if it is undertaken in a workmanlike manner. Whether a knapsack or a bucket pump is being used, some form of staging from which to spray is necessary when the trees are high, such as a large case, trap, or dray. By adopting this means, combined with care, very good results should follow the use of either make of pump.

SPRAYS FOR THE MONTH GENERALLY.

Pip-fruits.—Codlin-moth, leaf-roller, pear-slug: Arsenate of lead, powder 1 lb. (or paste 1½ lb. to 2 lb.) to 50 gallons of water. Spray every three weeks.

Woolly aphis: Black-leaf-40, 1–800, combined with arsenate of lead.

Red mite and other sucking-insects: Black-leaf-40, 1–800, lime-sulphur, 1–100 to 1–120—or atomic sulphur, 10 lb. to 100 gallons water—combined with arsenate of lead.

Powdery mildew: Lime-sulphur, 1–100 to 1–120; or atomic sulphur, 10 lb. to 100 gallons water.

Black-spot: Pears—bordeaux, 3-4-40; or lime-sulphur, 1–80 to 1–100. Apples—lime-sulphur, 1–100 to 1–120.

Stone-fruits.—Red mite: Whale-oil soap; atomic sulphur, 8–100; or Vistolene, 1–100.

Black aphis: Vistolene, 1–100.

Brown-rot: Lime-sulphur, 1–125; or atomic sulphur, 8 lb. to 100 gallons.

Cherries are very subject to attacks of brown-rot, and it would therefore be advisable to keep such fruits as peaches and nectarines coated with one or the other of the mixtures mentioned until all danger of affection from the cherry crop is passed.

PRODUCTION OF HIGH-GRADE FRUIT—THINNING THE APPLE CROP.

Year by year the orchard areas of the Dominion have been considerably increased, and naturally year by year considerable areas of new orchards are coming into bearing. Even if all planting were to suddenly cease such new bearing must continue to be the case for several years to come. Although restricted for the time being, orchard planting is not at all likely to be discontinued altogether. As a matter of fact, the indications are very much the other way, and it would not be surprising to find in the near future orchard extension being carried on as actively as ever.

It is beyond doubt, however, that orchard extension has been progressing very much more rapidly than our local requirements demand, and as a result—particularly in face of the fact that there is little likelihood of our export trade being renewed for some time—there is an interesting and critical time facing our fruit industry. How critical this will be time only can tell, but much will depend upon the nature of the next season or two and the general policy adopted by those engaged in the industry. There is little doubt that this policy will be shaped to deal co-operatively as far as possible with all matters of storage, handling, packing, and the sale of fruit; to develop the local markets to their fullest extent; to reduce the percentage of inferior fruit grown; and to utilize as much of the surplus fruit as possible by means of evaporation, canning, jam-making, cider-making, &c.

The grower should specialize as far as possible in the production of high-grade fruit. This is equally essential whether he handles his crop himself or has it handled for him by his co-operative company. In either case the percentage of low-grade fruit placed upon the market should be considerably decreased, while the higher-grade fruit should be correspondingly increased.

In raising a crop of fruit to meet these requirements there are many things to be considered and either practised or avoided. One of the principal of these is the practice of judiciously thinning the crop to meet the requirements of the tree. While peach and apricot growers are quite satisfied that the thinning is absolutely essential to the production of high-quality fruit, the practice has not yet become general among apple-growers. Those who have adopted the idea, however, are quite satisfied that under normal conditions there is fully as much to be gained by thinning the apple crop as is the case with the stone-fruits mentioned.

The advantages claimed for thinning include the regulation of the bearing-habit of the tree, thus ensuring a more evenly regulated crop each year, and fruit of a more regular size and of better colour and quality, thereby increasing the market value of the crop as well as reducing the labour of sorting and grading. Thinning also affords the opportunity of removing disease-affected and otherwise damaged fruits, and through the apples being made to hang separately on the tree it simplifies spraying and the dangers of moth-infection.

Thinning should be done when the fruit is 1 in. or 1½ in. in diameter. The extent to which the fruit should be thinned depends on the variety, season, age, and vigour of the tree. Therefore one or two seasons' practice and observation is necessary for arriving exactly at what is required. Some growers favour reducing those varieties that produce their fruit in close clusters to the single fruit in the centre of the cluster. Unless the tree has an extra large number of clusters this is a somewhat heavier thinning than is required. Two or even three apples to the cluster—particularly in the case of open-cluster varieties—may be left with advantage. Other varieties should be thinned to 5 in. or 6 in. between the fruits. But, as before stated, a little experience is required, and the sooner this experience is gathered and put into practice the better it will be for the fruit industry.

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

CARE OF YOUNG STOCK.

HATCHING operations being all over, and the bulk of the chickens at a safe age, the most important work to be attended to in December is caring for the young stock after they leave the brooder.

Correct management of the chickens at this age is of the utmost importance. True, they have passed the most critical stage of their life and to a great extent are able to look after themselves, but on no account can any risk be taken with them. Good breeding, hatching, and rearing to this age are essentials to the production of healthy and productive stock. The fact, however, should not be forgotten that any set-back during any period of the developing stage is never caught up.

Before the chickens are removed to the colony-house it should be thoroughly cleaned and well bedded down with straw, pine-needles, or other suitable material, in order to guard against dampness. Damp quarters are a common cause of many troubles affecting chickens after leaving the brooder. On no account must chickens be coddled at this age, but care must be taken not to go to the other extreme. The one is just as unwise as the other. The hardening-off process must be done by degrees, care being taken at all times that an ample supply of fresh air is provided.

Usually when chickens are first placed in a cool-brooder they will huddle together in corners, with the result that a sweated condition is set up, and this is fatal to chickens at any time. Heavy mortality takes place every season through no other cause. Because chickens huddle in corners it does not necessarily follow that they are in need of greater warmth. The trouble is usually brought about by the desire for seclusion. Being reared to this age in a covered-in enclosure the chickens naturally look for similar conditions, and are thereby induced to huddle. One of the best arrangements to prevent huddling

is to have a light frame covered with scrim, fitted with a curtain of sacking around the four sides, and hanging about 2 in. from the ground. This should be placed in a corner of the house, and may be kept in position by means of legs, or suspended with wires to the desired height. It is always advisable to have the corners of a colony-house well rounded off with wire netting, so that, in the event of huddling, the chickens can secure fresh air from the back.

It is important that the sexes be separated as soon as they can be determined. The males intended for table purposes require much different treatment from that of the pullets required for the production of eggs.

Correct feeding of the growing pullet is of much importance. Only good, plain, nourishing food should be supplied. In order to guard against bringing the bird to too early maturity, forcing-materials, such as meat or its substitutes, should be sparingly fed. In fact, when a decent range is available these foods may be eliminated from the ration. To force the growing pullet is always a mistake. A point to be remembered in this connection is that when a pullet commences to lay she ceases to grow. This means that she will never grow to a standard size, nor lay the desired-sized egg, as does the bird which comes to lay in its due season. It stands to reason that an undeveloped pullet cannot lay heavily and at the same time make any further growth. The energy necessary to reach maturity will obviously be diverted to egg-formation.

A very common but mistaken idea is that early maturity indicates heavy egg-laying power. For a bird to be a long-season layer of good marketable eggs she should not commence her season of production until she is at least six months old, and this may even be extended in the case of the heavier breeds. To secure winter eggs the object should be to breed birds at such a time and manage them in such a way that they may develop and commence to lay in April.

While a forcing-diet for the undeveloped layer is a mistake, this is not to say that her food should be stinted. She should be given a liberal supply of grain and green foods, while as much range as possible should be provided. The only safe way of making sure that the growing birds get all they require is to have food in its dry state always before them. This may consist of ground grains, pollard, bran, &c., and be fed in hoppers. Of course, the birds will be all the better if given moist mash at the usual feeding-hours.

In the case of cockerels intended for the breeding-pen, these should be treated in a similar manner to the pullets, especially in regard to providing ample range. Where cockerels are being reared for the table the opposite course should be taken. The exercising-space should be curtailed, while a liberal supply of soft forcing-food must be fed in order that the birds may be marketed at four and a half to five months old in a prime plump condition. The sooner a cockerel is marketed after this age the greater is the profit to be made from it.

SOUND ECONOMY.

With the high prevailing cost of foodstuffs the poultryman cannot afford to have any weakness in his management, or the margin of profit over cost of production will be seriously reduced. As is the

case in other branches of farming, rule-of-thumb methods must give way to systematic procedure based on the most approved principles. It has been possible in the past for the poultryman to make a good profit while neglecting many important details of the business. If these weaknesses be now corrected the money thus saved will go a long way towards counterbalancing the increased cost of production. In poultry-keeping it is the little things properly attended to which make all the difference between profit and loss. Very often the management may be correct to a great degree, but by not realizing what attention to small details really means the profits are reduced in consequence.

The lack of sound economy is one of the present-day weaknesses in the business of poultry-keeping. For instance, it is not uncommon to see several males running with the laying-flock—birds which serve no useful purpose whatever and are simply "eating their heads off." The breeding season has now passed, and unless a male is considered to be a suitable bird for next year's breeding-pen he should be got rid of at once. It should be remembered that in a laying-flock male birds are not necessary nor desirable; more eggs and better eggs will be produced without them. Then, again, infertile eggs will keep longer and preserve better than those that are pregnated. The ideal of the poultry-keeper should be never to have on the plant a bird which is not paying its way or which is likely to be a drain on the profits of the flock.

This is certainly not the proper season for culling a flock of hens. If they have been worth keeping till now they are surely worth keeping longer. The present is the natural laying season for bird-life, and it is a very inferior bird that will not return some margin of profit over the cost of her keep, providing she is well fed and properly managed. Of course, in the case of broken-down hens or those showing signs of a weakened constitution, these should be weeded out at all times.

On no account, under present conditions, try to rear a weakling chicken. A point to be remembered is that constitution is the base of heavy-producing and disease-resisting stock. It is therefore obvious that to waste time over a weakling is not only inviting an outbreak of disease, but is decidedly unprofitable.

Allowing broody hens to sit on the nests for days at a time, imagining that the natural rest is essential to best results, is another common weakness. Not only does this mean a loss in regard to eggs, but the development of vermin is thereby encouraged. If a bird is properly fed and maintained in good condition she needs no rest for the comparatively short laying-life demanded of her in these days of forced egg-production. As soon as a bird is found on the nest by night she should be removed to a broody-coop. Do not make the common mistake, however, of starving broody hens, or ill-treat them in any way as a short-cut to breaking the broody fever—for instance, by holding their heads under water until they are on the point of drowning. Such a practice is not only unwise, it is decidedly cruel. Broody hens should be given all the food they will eat, so that they will resume laying in the shortest space of time possible. The day has long gone for considering that the laying-hen is all the better for a rest.

Another expensive present-day leak is the amount of food consumed by sparrows. The loss from this cause is considerable in normal times, but with the present high cost of food it must to a great extent affect the profit of many poultrymen. The only safe course to prevent this waste is to feed the birds in an approved open-front house, the front being covered with 1-in.-mesh wire netting. When this is not possible, and the birds have to be fed in the outside runs, it is always as well to remove any unconsumed food about fifteen minutes after the food is put down.

In successful poultry-keeping the sole aim must be to show the greatest profit over cost of production. While good stock properly housed in clean quarters, together with a plentiful supply of nourishing food, are the chief essentials to this end, it should never be forgotten that the maximum return can only be attained by eliminating losses and making the greatest possible profit from everything in the place.

THE APIARY.

E. A. EARP, Apiary Instructor.

FORMING NUCLEI.

With the approach of the main honey-flow and the prospect of more settled weather the beekeeper can turn his attention to the question of forming nuclei, either with an eye to artificial increase or for queen-raising purposes. Whatever the object for which they are produced the simplest method of forming nuclei is as follows: From the strongest colonies in the apiary take combs of sealed brood with adhering bees. Place two of these combs in each nucleus-hive, together with one comb of honey and an empty comb. It is as well, if the size of the hive will permit, to add a feeder. Close the entrance of the nucleus-hive by tacking over it a piece of perforated zinc or wire cloth, and place the newly formed colony in a cool place for twenty-four hours. At the end of this time the hive may be placed on its permanent stand and the entrance opened. Some of the field-bees will return to the parent hives, but in the meantime much of the sealed brood will have hatched, and thus the absconders will hardly be missed. The small colony can at any time be given a ripe queen-cell, and under favourable weather conditions will soon possess a laying-queen.

Nuclei can be built from one or two strong colonies, each of which should produce four or five small colonies; or several hives in the apiary may each be robbed of a frame of brood, thus providing increase while leaving the full colonies practically undiminished. When the young queen commences laying in a nucleus hive she should be left in possession until she has filled two frames with eggs, when she may be removed and given to a colony which requires requeening. The nucleus should at the same time be supplied with a ripe queen-cell, and the process repeated as long as young queens are required.

REQUEENING.

During the early part of the summer the apiarist should turn his attention to the question of superseding old and failing queens, especially when the bees show no disposition to do the work themselves. With the aid of a few nuclei young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured and form an easy solution of the requeening problem. No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming impulse. In New Zealand it has been proved that the best months for raising queens are from November to January. During this period everything is favourable to the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming-period. In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees will then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming influence, and wherever there is an opportunity they should be saved and failing queens destroyed. A handy method of introducing virgin queens is by the smoke method. The old queen must first be removed from the hive that is to be requeened. The entrance then is contracted, and a few vigorous puffs of smoke are forced in at it. Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance, piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke. The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly and left like this till the next day, when the full entrance can once more be allowed.

EXTRACTING.

Preparations for extracting the honey must be well in hand. By the time these notes are published the main flow should have started in the North, but it will depend entirely upon weather conditions. In the South the flow is fully three weeks later, and extracting rarely commences before the New Year. It is well to get all the arrangements for handling the crop completed before the honey is sealed and ready for the extractor. It does not take a great deal of time to prepare extra supers and frames, but these are of inestimable value to the beekeeper when the main honey-flow commences. Every year immense quantities of honey are lost through lack of proper gear for handling the crop, or through the unreadiness of the beekeeper when the hives are full of honey. It is poor economy to keep one's supplies so low that the bees hang about outside the hive and loaf for want of combs in which to store the honey.

Room should be provided for the workers as soon as the first honey is capped, either by extracting the combs or by supplying them with another super. Keeping the extractor running from the beginning of the honey-flow till the end is good beekeeping, provided the honey is not extracted while in an unripe condition. Although some authorities advocate leaving all the honey in the hives until the end of the

season — thereby building colonies three and four stories high — the result is rather heavy work, and this method is not advisable in southern localities. Where the summer is short and variable the risk of getting the honey chilled by leaving it in the hives till the end of the season is too great. Honey, except in a few instances, is best extracted when warm from the hives. In fact, where there is any tendency to "thick" honey, extracting while the honey is warm is the only way to obviate breaking the combs in the extractor.

Comb-honey should be treated in the same way. All sections should be removed from the hives as soon as they are filled. This makes them less liable to be daubed with propolis and to become "travel-stained" by the constant passage of the bees.

The extractor, tank, and all the rest of the gear connected with the handling of honey should be scalded and thoroughly dried before commencing the season's work. Honey, by reason of its peculiar method of production, does not call for the daily cleansing required by other foods, but it behoves the beekeeper to see that his honey-house is as trim as hands can make it. After the extractor has been scalded it should be kept covered with a clean washing cover when not in actual use, and every receptacle containing honey should receive the same treatment. These covers are easily made and washed, are inexpensive, and add much to the condition of honey as an article of food. No bees, flies, or any extraneous matter should be allowed to touch the honey once it leaves the extractor, and from the time the bees gather it till it leaves the beekeeper's hands for market his aim should be to produce a dainty and attractive article of food.

EXTRACTING-APPLIANCES.

It is useless trying to work bees profitably without proper appliances. These consist of an extractor, uncapping-knives, uncapping-can, and settling-tanks. Many beekeepers make the mistake of trying to get along with any makeshifts, but experience will teach that it is a poor policy to endeavour to work bees without an up-to-date equipment. However small the number of hives kept, if extracting is the objective it will be found to be most profitable to install a four-frame machine. Costing a little more at the initial outlay, it will soon pay for itself in labour-saving, and enable the beekeeper to meet the biggest flow. In any case he should not be persuaded to purchase a machine that will not reverse. Fixed machines are labour-makers, besides being messy in working. When fifty or more colonies are worked it will be found that a power plant pays for itself over and over again. Prior to the war the cost of installing a power plant was only a moderate figure, and yet relatively few plants are to be found in use.

Second in importance is a good tank. No apiary equipment is complete without one or two good tanks. Too little attention is paid to maturing the honey when out of the hive, and freeing it from the minute particles of wax which float on its surface. It must be left to the beekeeper to decide the size of tank he requires, this depending on his needs and conveniences. Particulars of the construction of a suitable tank to meet the requirements of an apiary of 100 to 150 colonies are given in the Department's Bulletin No. 55, "Bee-culture."

For rapid working two ordinary uncapping-knives are very convenient, but as yet no better invention has been given to the bee-keeping world than the steam-heated knife. This knife obviates the necessity of constantly dipping the cold knives into hot water, and the work of uncapping can proceed uninterruptedly. There are several uncapping-cans and melters on the market, most of which are more or less satisfactory, but the perfect capping-melter has yet to be invented.

DISEASE.

If the weather conditions have not been favourable for the treatment of disease this should be undertaken when the first opportunity occurs. Do not delay until the main flow arrives. Remember that if colonies are treated early enough a surplus of honey will be secured and the expense of treatment recovered. Handling clean bees is a constant source of delight, but diseased bees are a never-ending cause of trouble. Full particulars of the treatment of disease were given last month, but if fuller information is required this is given in Bulletin No. 1, "Foul-brood in Bees," which can be obtained free from Wellington or from the Apiary Instructors in each centre.

VITICULTURE.

S. F. ANDERSON, Vine and Wine Instructor.

THE VINEHOUSE.

THE growth of the vines is now very strong in most houses, the disbudding and suppression of superfluous growth having concentrated the efforts of the plant on those portions left for fruit-bearing. The first pinching-back of the fruit-bearing shoots will require attention. The shoots should be allowed to grow some five or six young leaves beyond the fruit before being stopped or pinched with the finger and thumb. This develops the leaves between the fruit and the stem, as well as the fruit. Further growth is rapidly made at the place pinched, and sub-laterals may push out at the axils of leaves behind the fruit. These can be pinched off, leaving a couple of leaves. The growth made from the end beyond where the first stopping was done may be allowed to get another five or six young leaves before the next stopping is carried out. Now we leave another two leaves or joints beyond the last stopping, making four joints beyond the fruit. This stopping will require to be done three or four times, always leaving two leaves or joints more than previously. Do not leave the stopping of shoots till much growth has been made and then break off long pieces. The vigour of the vine has then been expended on what is taken away, whereas by judicious and timely work it is turned into producing large leaves and fruit and strong short laterals. To keep these in a healthy natural state give regular attention to ventilation.

THE VINEYARD.

The conditions imposed on the vigneron by the war may no doubt greatly affect work in the vineyard, and a natural question will be what part of it could be left undone for a season without permanent injury to the vines. The regular pinching and tying of the vines, and control of the growth, could be suspended for a season without injury. Some rougher method of tying back the stronger growth would be required, however, if horse cultivation is done. The suspension would not lessen the yield of fruit or increase mildew. The only drawback would be a slightly later ripening of the fruit. As to working the soil, provided weeds could be kept mown to prevent seeding, this might be omitted; but if horse-labour is available it would be nearly as quick to horse-hoe as to mow the weeds. Mowing can be regarded as an alternative. It must be understood that the general methods of viticulture set forth in the *Journal* should in nowise be altered, and that the foregoing remarks apply only to one season's treatment, which may be demanded by the difficulty of obtaining labour.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

DECEMBER should be a busy month, as much planting is necessary if a full supply of garden-produce is to be maintained. The main planting of broccoli should take place, also cauliflowers, brussels sprouts, and the first lot of savoys. The main planting of savoys and cabbages can well be kept over till January, except that if the supply of cabbages is likely to be short some may be planted in December. January, however, is early enough to plant for winter use beginning about April.

Plant celery in well-manured trenches, and water thoroughly after planting, which in hot places is best done in the evening. Two sowings of peas should be made during the month, and one sowing of French beans. Sow also turnips and radishes. Pumpkin, marrow, melon, and cucumber plants should be in strong growth. The long runners that all these plants send out must be pinched, so as to encourage the growth of laterals, which are the fruit-bearers. Lettuces should be sown at short intervals during the hot months, so as to have them in a fresh condition. Sow in lines, and thin the plants to 8 in. or 9 in. apart. This method saves the trouble of transplanting and watering necessary to re-establish the plants.

Leeks need not be planted in trenches as was formerly done, the trenches causing a great waste of space and labour. Plant in lines 15 in. apart. First draw a drill, as though peas were to be sown. Strew a mixture of superphosphate and bonedust along the drill.

The plants should be 8 in. to 9 in. long. Do not trim the roots of the plants, nor cut the tops. Plant with a dibber. Thrust in the tool its full length, and work it with a circular motion to enlarge the hole. Insert a plant to its full length in the hole, then lift it sufficiently to straighten the roots. Now thrust the dibber into the ground a few inches away from the plant, and with good pressure bring the handle up against the plant. This will close the hole firmly. On no account fill the hole by pushing soil into it. If this is done the plants will not make satisfactory growth.

Tomatoes.—Plants are now growing freely, and should be secured to their supports so as to prevent injury by wind. All side shoots other than those required as leaders should be pinched off. It is not usual to have more than two leaders; one may be the natural leader of the plant, the best-situated side shoot being retained as the second leader. Keep the surface soil loose around the plants. If the soil has not been recently manured, give a light dressing of superphosphate and bonedust. Apply the fertilizer as though it were grass-seed, and that will give the right quantity without the trouble of weighing and calculating. Wood-ashes in liberal quantity are bound to do good to tomato-plants, as they contain potash, which is indispensable to the plant. Authorities now report that the so-called "sleeping disease" is due to want of potash. But it must not be thought that the application of potash will effect a cure: if the disease gets a hold there appears to be no remedy.

Potatoes.—Early potatoes are now being dug generally. As this is done before they reach maturity a good opportunity is afforded for selecting seed for next season's early crops. It has been proved beyond argument that immature tubers produce the best crops. When the skin is set so as not to rub off easily they are fit for storing for seed purposes. When extra good roots are lifted the tubers weighing about 2 oz. each—a little more or a little less—should be kept. Lay the tubers in the sun for a day or two to toughen the skin, then store in a cool airy place. Spraying for blight may not be necessary in all cases, yet it is a wise precaution. Dry conditions of soil and atmosphere may save the crop from blight, but good moisture-holding soil favours heavy night dews, and in such places blight may be troublesome though the weather be dry. The potato-moth has also to be reckoned with in hot districts. Arsenate of lead is the best remedy at present in use, and may be added to the bordeaux spray, allowing ½ oz. to each gallon of spray mixture.

PLANTING OUT VEGETABLES.

The weather being usually hot and dry at this time of the year, some steps must be taken to keep the plants fresh while they get a roothold in the soil. In the first place the soil should be fairly firm. When recently turned over it is liable to be too loose, and dries out too rapidly—at least as regards a few inches on the top. The young plants root most freely when the soil is firm, because there is better contact. Firm soil holds moisture better than loose soil, and, provided the surface is kept loose, capillary action is better. In some of the hottest parts of the Dominion, in places where the soil is light

and poor, the growing of these crops is wellnigh impossible unless there is an abundant supply of water. In a general way, and on soil that is considered fairly good garden soil, much watering is not required. It is, indeed, often a waste of time to give it. Watering after planting is always best avoided, except in the circumstances just referred to. When the planting is small, and a dibber is used to plant with, the best way is to make the hole for a plant, fill it with water, put in the plant before the water runs out, or put the plant in before the water. In either case close the hole at once, so as to convert the soil about the roots of the plant into a puddle. This is the correct way of puddling in. Loose soil is dragged around the plant as a mulch, and moisture will be retained long enough to establish it. The best way to plant, however, is with a hoe, and if the planting is of any extent the hoe should be used. A good man using a dibber can plant fifteen hundred or sixteen hundred plants in a day of eight hours. The same man using a hoe can put out from four thousand to five thousand plants in the same time, and the plants—if there is any difference—are planted in a better manner. A hoe with a handle about 15 in. long is used. The hoe is driven into the soil and simultaneously pulled toward the operator. This leaves an open space at the back of the hoe. The roots of the plants are inserted in this space, then the hoe is lifted out and the soil falls back against the plant. This, besides being a rapid method of planting, provides that only moist soil comes in contact with the plants. The final act of planting is to give the soil above the roots of the plants a smart punch with the head of the hoe to firm the soil. To enable the plants to quickly re-establish themselves they should be placed in a tub in which there is just enough water to cover the roots, and in about an hour they will become filled with water. When taking them from the tub lift them in bundles. On the bottom of the tub there will be a layer of mud, soil that has fallen from the roots. Take a handful of this mud and rub it on the roots of the bundle of plants. This will protect them from sun and air while being planted, and the plants will not require watering after planting.

Shortly after the *Journal* went to press last month news was received—with deep regret—of the death in action at the front of Sergeant T. C. Webb, jun., a letter from whom was published in that issue under the heading of "A Note from France."

The Ruakura Apiary is going strong this new season, and everything is in very good trim. The scheme of queen-rearing is proceeding satisfactorily, and Italian queens are announced for sale. Another of the new activities is the making of comb-foundation on the premises. Eight cadets are being trained at the apiary this season, of whom four are women.

When fowls are well housed, well fed, and properly managed, and they become too fat, it may be taken for granted that they are a poor laying-strain.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in the *Journal* must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HEIFERS WITH SWOLLEN UDDERS.

"LEARNER," New Lynn :—

What treatment do you recommend for heifers with inflamed udders after calving ?

The Live-stock Division :—

The treatment is to bathe the udder well with hot water, but not hot enough to cause pain. Then dry gently with a soft towel, and apply a little camphorated ointment ; rub this in well but gently. A dose of Epsom salts (say, 1 lb.) and 1 oz. of ground ginger will also be found beneficial.

DRESSING PASTURE AFTER LIME.

"LEARNER," New Lynn :—

I am top-dressing old pasture with carbonate of lime at the rate of 25 cwt. per acre. The land is mostly heavy clay, with patches of brown loam. In addition, I intend to use some artificial manure in the autumn. Kindly advise what would be the best to use, and how much.

The Fields Division :—

For your land use 3 cwt. of manure per acre, made up of 2 cwt. of superphosphate and 1 cwt. of blood-and-bone. This should be applied early in March.

PRESERVING CUCUMBERS IN BRINE.

"SOUTH ROAD," Manakau :—

Please inform me whether there is any way, other than pickling, of preserving cucumbers in the whole state.

The Horticulture Division :—

Cucumbers can be preserved whole in brine. The brine is prepared by stirring salt into a sufficient quantity of water until a potato will float on the liquid. The brine is boiled for fifteen minutes, and left to cool before putting it in a cask. Then fill with cucumbers. The head of the cask must be strongly fixed or weighted, to keep the cucumbers below the surface.

CASTRATION OF CALVES.

F. J. BEAR, Raglan :—

Is it better to castrate a calf when the animal is old or young ? I shall be glad of information in regard to the best method.

The Live-stock Division :—

Calves should be castrated when young. The best method is to wash the purse first. The hands should be disinfected, also the knife to be used. Then proceed to cut an opening low down and just large enough to allow the testicle to come out. Catch the cord between the forefinger and thumb, and twist it off. Afterwards proceed to remove the other testicle in the same way. No after-treatment is required, but it is most essential that the calves be kept in a clean, sweet paddock until they have recovered.

GERMINATION OF DANTHONIA PILOSA SEED.

J. EMPEN, Kuaotunu :—

I am told that *Danthonia pilosa* seed will not germinate if held over for the following season. As I could not burn last autumn on account of the wet weather I have not used my seed, and would like to have your opinion on the question.

The Biologist :—

Danthonia pilosa is often harvested in an immature condition, and in such cases it loses germination rapidly. If harvested in a proper condition, seed up to three and four years of age will give a satisfactory germination. Your best plan is to send forward a sample for testing the germination capacity. This work is done free of charge for farmers. (Address: The Biologist, Central Development Farm, Weraroa.)

LEECH ON HAWTHORN-BUSHES.

"SUBSCRIBER," Dannevirke :—

During the last two summers my hawthorn-bushes, which are five years old, have been eaten brown by a thin slimy black slug. Please tell me what to spray them with, when to apply it, and how to prepare it.

The Horticulture Division :—

The brown appearance of the leaves of your hawthorn-bushes is caused by the slug of the saw-fly (*Selandria cerasi*) eating the epidermis off the upper surface of the leaves. The fly makes a cut in a leaf and lays an egg in the cut. The larva is said to hatch in two days, and feeds upon the leaf as described. It is the leech that attacks pear, cherry, and plum trees. This leech is easily destroyed and damage avoided by prompt action. Spray with arsenate of lead, 1½ lb. to 50 gallons of water, or hellebore powder, ½ oz. per gallon of water. Dusting with a mixture of lime and dry dust or sand is effectual, but more troublesome.

LUPINS FOR GREEN-MANURING IN GARDEN.

J. GOFTON, Woolston :—

Kindly advise me in regard to the cultivation of lupins for manurial purposes in a half-acre garden—when and how to sow, distance between drills, and when to dig in. The soil is a good deep loam.

The Horticulture Division :—

White lupins may be sown at any time that danger from frost is past. The crop may be dug in when from 15 in. to 18 in. high. If you have means for harrowing the seed in it might be best to broadcast. If it is desired to sow with a small drill the rows can be from 12 in. to 15 in. apart. A sufficient quantity of seed for half an acre will be 45 lb.

SEPTIC ABSORPTION FROM NAVEL IN CALVES.

W. B. DAVIS, Makatuku :—

I have had several calves suffering from lameness. When they are about six to nine days old a swelling of the hock takes place, and the following day the stifle-joint on the opposite leg swells up and the calf is unable to stand. The calves so affected have all been good healthy calves, and fed on nothing but new milk. There has been no loss of appetite, the calf looking quite bright about the head.

The Live-stock Division :—

The trouble is due to septic absorption from the navel-cord, which takes place just after birth. Keep the calves under clean conditions, and wash the cords with some antiseptic every day for a week after calving. Regarding the lameness, there is but little you can do, as treatment now would be very expensive. The general health of the animals being good, a recovery may be looked for, but may be slow.

WESTERN WOLTHS RYE-GRASS FOR FORAGE CROP.

W. J. PREEST, Taupiri :—

Kindly recommend the best kind of green feed for dairy cows for growing in a small paddock which is covered with sorrel. The ground is fairly well drained tea-tree swamp. We prefer soft turnips, but the sorrel smothers them.

The Fields Division :—

There is nothing better for the conditions named than Western Wolths rye-grass, sown at the rate of not less than 30 lb. per acre, with 2 cwt. of basic superphosphate.

CONTROL OF INKWEED.

"SETTLER," Raglan County :—

When is the best time to cut inkweed; and is it any good just slashing it above the ground?

The Fields Division :—

The Fields Inspector in charge of your district advises that the best method of eradicating inkweed is by cutting during the months of January and February, afterwards stocking the land heavily with cattle. The weed does not stand heavy stocking, and by treating as stated the plants will disappear in a season or two.

LICE ON FOWLS.

"POULTRY," North Auckland :—

Please advise whether powdered sheep-dip dusted on fowls will kill lice. If not, what would you recommend as an inexpensive cure?

The Live-stock Division :—

Body-lice may be got rid of by dusting the birds with carbolic powder, or with any of the preparations of insecticide on the market. Powdered sheep-dip would probably serve the purpose. If fowls are provided with a dust-bath they can rid themselves of body-lice in the natural way, and treatment will seldom be found necessary. Head-lice are usually found with their heads deeply buried in the skin, among the feathers, on the fowl's head and neck. For these a light application to the head of an ointment of two parts of lard to one part of sulphur is recommended.

LAMBS ATTACKED BY BLOOD-SUCKING ANIMAL.

F. NEWMAN, Owen River, Nelson :—

I am having a lot of trouble and loss through some pest causing the death of a number of my lambs this season. Every lamb that I have examined has been killed in the same way by being bitten in the throat about an inch below the ear, and in most cases the puncture is on both sides of the throat. Whatever it is that is attacking them does not kill them outright, as I have seen several with their throats much swollen, and they appear quite dazed, through loss of blood, and die in about three days. The only animal that I suspect of causing this loss is the weasel or stoat, as I have seen and shot them on this clearing. I have been told that a polecat will do it, but I have no evidence of any being seen here. Most of the lambs killed are the largest on the clearing, and I am at a loss to know how a weasel could manage some of the big lambs that have died.

The Live-stock Division :—

Although comparatively rare, there are undoubtedly occasional instances in which young lambs and also young pigs in New Zealand have been attacked by some blood-sucking animal. So far as we are aware, such attacks have never been traced to either the stoat or weasel, but to an overgrown ferret of the polecat tribe. It is more than likely that your losses are due to perhaps one or two of these animals, and if it were possible to have them shot or otherwise destroyed you would no doubt find the trouble cease.

ESTIMATED AREAS UNDER WHEAT AND OATS.

THE appended statement was issued by the Government Statistician, under date 31st October, 1917:—

Following the procedure adopted last year, cards have again been sent out by post to grain-growers in the Dominion asking them to state the areas they had sown or proposed to sow in wheat and oats for the present season. The cards returned have been tabulated, and on the results obtained an estimate has been based of the total areas sown or to be sown. The estimates are subjoined.

WHEAT AND OATS.—APPROXIMATE AREAS, 1916–17, AND AREAS ESTIMATED AS SOWN OR TO BE SOWN, 1917–18.

	Wheat. Acres.	Oats. Acres.
Areas, 1916–17:—		
For threshing	217,700	177,494
For chaffing, &c.	3,720	354,496
Total harvested	221,420	531,990
Not harvested	2,871	32,736
Grand total	224,291	564,726
Areas, 1917–18 (estimated):—		
North Island	9,932	49,155
South Island	284,013	435,082
Total	293,945	484,237

KUMARA-PLANTS.

WITH reference to the notice in last month's *Journal* regarding the distribution of surplus kumara-plants from the Tauranga Horticultural Station, several hundred applications were received from different parts of the Dominion. The Manager of the station has sent out a large number of plants, but the available stock is now exhausted, and it has been impossible for him to deal with all the applications. Persons concerned will please accept this notice, as individual replies cannot be sent to all.

Maximum Price of Wheat.—An Order in Council dated the 15th October, 1917, revoked clause 4 of the regulations gazetted in February last, which provided that the maximum prices prescribed for wheat should not apply to the sale of quantities under 50 bushels. Small sales are therefore now on the same price basis as larger deals.

Branding of Wool by Growers.—It is notified by the Controller of the Department of Imperial Government Supplies, for the information of all wool-growers throughout New Zealand, that in accordance with instructions received from the Imperial Army Contracts Wool Department, London, all wool sent by growers to Government woolbrokers for valuation and purchase must be branded with the grower's mark on one end and on one side only of each bale. The brand must be placed on one of the flat sides—in other words, on either of the sides of the bale not exposed when the doors of the press are open. Letters and figures appearing in the brand must be not less than 3 in. in height. In any case where the branding of the wool has not been effected by the owner strictly in accordance with these requirements, the Government woolbroker to whom the wool is forwarded will correct the faulty branding at the expense of the grower.

Harvest in Marlborough.